IN THE UNITED STATES DISTRICT COURT

FOR THE DISTRICT OF DELAWARE

IN RE: INTEL CORP. MICROPROCESSOR ANTITRUST LITIGATION	MDL Docket No. 05-1717-JJF
PHIL PAUL, *on behalf of himself and all others similarly situated,* Plaintiffs, v. INTEL CORPORATION, Defendant.	Civil Action No. 05-485-JJF CONSOLIDATED ACTION **PUBLIC VERSION**

DECLARATION OF KEITH B. LEFFLER

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I. Background and Experience

1. I am an Associate Professor of Economics at the University of Washington. I received my Ph.D. in Economics in 1977 from UCLA. I have teaching and research experience in the area of industrial organization. My specialty within industrial organization is antitrust economics including the study of monopolization and the impact of monopolies on consumers. I have taught classes and conducted research in industrial organization and antitrust economics for over thirty years.
2. I have been performing economic analysis in antitrust matters throughout my academic career. I have been qualified as an economic expert in proceedings before federal courts, state courts, the Federal Trade Commission, and federal and state regulatory agencies. I have analyzed economic issues related to class certification and/or damage estimation and overcharge pass-on in a number of industries including infant formula, propane, residential doors, prescription drugs, nutritional feed additives, cigarettes, and computer operating systems. My curriculum vita is attached to this Declaration as Exhibit A. My experience, qualifications, publications and testimony given in the last four years are summarized therein.

II. Area of Analyses and Bases for Opinions

3. I have been asked by interim class counsel in this case to describe the type of economic analysis, evidence and data that can be used to determine the scope of the impact, if any, of Intel's alleged anticompetitive conduct concerning Intel x86 microprocessors on the proposed class. I

have also been asked to describe the methods by which any damages to the class of end-users can be calculated on a class-wide basis. To undertake this assignment, I have reviewed the First Amended Consolidated Class Action Complaint (Complaint), the AMD Complaint, documents and data produced in discovery by Intel, AMD and third parties, data I have collected on computer and microprocessor pricing, the depositions of the named class plaintiffs, and relevant economics and trade literature. Exhibit B to this Declaration lists the materials I have considered in forming my opinions. My review of these materials has verified and supplemented my understanding of economics of the marketplace for Intel x86 microprocessors. I have also relied upon my economics background and training, and knowledge of the semiconductor, microprocessor, and computer markets gained from previous consulting work, including my work for the Federal Trade Commission and the Department of Justice in the Microsoft cases, and my work on the class certification issue in the indirect purchaser Microsoft cases.

4. I understand that Class Plaintiffs (Plaintiffs) have defined the proposed class as end-user purchasers of personal computers containing Intel x86 microprocessors. The class definition includes purchasers of desktop and mobile personal computers (collectively, "personal computers" or "PCs") containing Intel x86 microprocessors, but excludes other Intel x86 based computing devices that are not personal computers such as servers and "embedded devices," as well as all non-computer devices and standalone x86 chips. The proposed class also excludes federal, state and local government entities.

5. For purposes of this Declaration, I assume plaintiffs will show, as alleged,

that Intel illegally maintained its market power in the relevant market for x86 compatible chips, that the illegal maintenance of that power began well before the beginning of the class damage period and continued subsequent to that date, and that the illegal acts prevented fair competition in the x86 microprocessor market.

6. I understand that at the certification stage, Plaintiffs need not prove the impact or quantify damages but only must present feasible means of doing so at trial on a class-wide basis. Thus, I have been asked to describe the analyses, evidence and data I would rely upon if I were to testify at trial as to the impact of Intel's anticompetitive conduct on the proposed class and as to the amount of the class's damages. I understand that at this time substantial discovery remains to be completed that will presumably be relevant to liability and damages. In any event, at this time I could not estimate the class members' damages because the necessary data have not been fully received or fully processed.[1]

7. To the extent that additional information becomes available that changes any of the opinions or the bases for the opinions offered in this Declaration, I will supplement the Declaration.

III. Summary of Opinions

8. I have reached the following opinions concerning class certification issues:

   A. Plaintiffs allege that Intel possessed and exercised monopoly power from at least the early 1990s. Preliminary class-wide analysis of the likely relevant economic market - the market for the sale and purchase of x86 microprocessors for personal computers - and Intel's dominance

[1] The attached Exhibit C summarizes the data received and requested to date.

of and margins in that relevant market supports Plaintiffs' claim of monopoly power.

B. Plaintiffs allege a variety of anticompetitive acts by Intel, including payments to and arrangements with key OEMs, distributors and retailers that prevented Intel's actual and potential x86 microprocessor competitors, and particularly AMD, from effectively competing with Intel. Preliminary class-wide analysis of discovery materials along with economic theory support Plaintiffs' allegations.

C. Assuming Plaintiffs' allegations are proven, basic economic principles imply that the prices of the relevant Intel x86 microprocessors would generally have been lower in the absence of Intel's anticompetitive conduct.[2] Preliminary examination of Intel's sales database shows small variance in the prices paid for Intel microprocessors at a point in time. The limited pricing variance appears to be related to differences among buyers (size, commitment, negotiating ability), and/or occasional special competitive situations. These buyer differences and the circumstances giving rise to occasional price competition would also exist in the absence of the alleged anticompetitive activity. Thus, in the "but-for" world (i.e., the world that would have existed but-for Intel's alleged unlawful behavior), variance in Intel's prices is expected but with the prices at a lower level.

D. Intel x86 microprocessors are sold to personal computer makers (known as original equipment manufacturers, or "OEMs") both directly and through electronics distributors for incorporation into personal computers that were ultimately purchased by the proposed class members. Because the alleged Intel anticompetitive activities began substantially before the start of the class damage period, any Intel overcharges would have been embedded in PC prices at all levels of distribution by the beginning of the class period. While there may be a lag between microprocessor price changes by Intel and PC price changes seen by end-users, those lags would be the same with or without Intel's alleged anticompetitive conduct. Thus, the relationships between Intel's lawful price changes and end-user prices are expected to be the same in the but-for and actual worlds.

E. The microprocessor in a personal computer is a component that is unaltered in form in the assembly of a personal computer. The microprocessor represents a very significant cost of making a personal computer. Personal computer manufacturing, and electronics distribution and retailing are highly competitive industries. In these circumstances, longstanding microprocessor overcharges will be

[2] By relevant, I mean those microprocessors that were not sold by Intel under special competitive situations that resulted in a competitive or below competitive price as explored further below.

reflected in OEM prices for personal computers.

F. The prices of personal computers are influenced by many factors including product features, reputation, marketing strategy, competition particular to segments of the market, and bundled products and services. However, these factors are independent of the overall price level of the Intel x86 microprocessors and of the alleged illegal activity. If the prices of a major component of personal computers, the Intel x86 microprocessor, are lower to all computer makers for a substantial period of time (as they would have been in the but-for world), and other factors explaining relative prices are unchanged, basic economic principles of competition imply that the entire price matrix of personal computers powered by Intel x86 microprocessors would be at a lower level.[3] Therefore, absent the alleged anticompetitive conduct by Intel, the manufacturers' prices of all Intel x86 based personal computers would have been lower.

G. Class members purchase personal computers containing Intel x86 microprocessors directly from computer makers, from Value Added Resellers ("VARs"), and from retailers. Retailers and VARs purchase personal computers for resale both directly from computer makers and from distributors. These various channels of distribution are highly competitive.[4] The relative prices among the various channels will be based on a host of factors including the competitiveness of the channels, warranty and repair policy, product knowledge, service, convenience, marketing strategy, and other bundled product or software features. However, none of these factors is impacted by a change in the price levels of Intel x86 microprocessors. Therefore, in the but-for world with lower prices of Intel x86 chips and lower OEM prices, the price matrix of all personal computers to end users is expected to be a lower level.

H. Determination of any Intel overcharges for x86 chips is amenable to standard benchmark approaches using data that are or will be available. These benchmarks include:
(1) Certain Intel products sold at particular times when the nature of competition was similar to that Intel would have experienced in the but-for world in the x86 microprocessor market.
(2) Other semiconductor markets subject to competition.

I. A number of alternative Intel products likely will be appropriate benchmarks. These benchmarks include:
(1) Intel products other than microprocessors where Intel faced greater

[3] By "price matrix," I simply mean the entire set of prices the Intel charged for a particular microprocessor.

[4] [redacted]

competition including:
(a) Networking chips;
(b) ARM chips;
(c) NOR flash memory.

(2) Intel x86 microprocessors in recent quarters when AMD was a more effective competitor.

(3) Particular Intel x86 microprocessors at particular times.[5]

J. Preliminary analysis of the margins earned by Intel in more competitive situations in x86 and non-x86 businesses compared to those generally earned from x86 microprocessors, and also compared to those earned by other computer chip makers in other markets demonstrates the feasibility of estimating any Intel overcharges to direct purchasers using class-wide evidence.

K. Any damages to end user class members (i.e., the amount of any Intel overcharge passed on to them) can be estimated using a class-wide statistical determination of the relationship between the microprocessor prices faced by Intel's customers and the PC prices paid by end users. Such analysis requires measurement of how a lower Intel price impacts end-user prices. This is known economically as "pass-on" analysis. The vigorous competition in the manufacture of personal computers and in the distribution and retailing of personal computers suggests that any Intel overcharge would affect a particular end user group the same regardless of the details of how the personal computer reaches them.

L. The data that are available or will be available in this case will allow estimation of the pass-on specific to particular end-user groups including PC purchases from OEMs, from retailers, and from VARS.

M. Preliminary analysis of the statistical relationships between costs to the OEMs and PC prices to the end-users demonstrates the feasibility and class-wide nature of the pass-on analysis. Preliminary analysis suggests that a 100% or higher pass-on rate of any overcharge will

[5] As discussed below, at this point in the case I do not have complete Intel sales data from which I can identify all net prices to OEMs. My preliminary analysis of the currently available data does indicate occasions on which a particular OEM received very low prices (compared to other buyers) on a particular purchase order. Preliminary analysis of the discovery materials suggests that, on occasion, Intel "supported" OEMs in direct competition with another OEM offering a less expensive AMD based personal computer by lowering the price of the Intel microprocessor. When complete Intel pricing data are available, unusually low Intel prices can be identified and matched to discovery information to confirm the reason for the low prices. As discussed in the overcharge section, depending on the final overcharge methodology, there may be limited situations in which, to be conservative, no overcharges are sought on certain identifiable personal computer purchases. This, however, does not imply there was no adverse impact on the buyers of those personal computers, as constraining competition retards innovation and diminishes AMD's ability to undercut even low Intel prices.

likely exist for all groups.

N. Any damages to the class members can be determined using the following formula:
$D_{MYST} = Purchases_{MYST} * OC_{MY} * Pass\text{-}on\%_{YS}$, where D_{MYST} are the damages from personal computer purchases with microprocessor M in year Y from source S in state T, $Purchases_{MYST}$ are the PC purchases with microprocessor M in year Y from source S in state T, OC_{MY} is the minimum overcharge to direct purchasers for microprocessor M in year Y, and $Pass\text{-}on\%_{YS}$ is the estimated pass-on percent for year Y from source S.

IV. The Intel x86 Marketplace - Background

9. Intel was founded in 1968 as the Integrated Electronics Corporation. Intel's original business was dominated by SRAM and DRAM memory chips. Intel introduced the first microprocessor, the Intel 4004, in 1970. It developed successor chips, the 8008 and 8080, but sales were modest until IBM chose Intel's 8086 chip for the IBM PC, introduced in August 1981. In November 1982, Compaq introduced its fully compatible IBM PC "clone." Other clone manufacturers followed and the PC market grew exponentially.

10. As part of its selection of the x86 architecture for its PC, IBM required Intel to license the manufacture of x86 microprocessors to a second source, AMD. At the time, AMD was a producer of RAM chips and it had reverse-engineered the Intel 8080 microprocessor. The relationship between AMD and Intel has always been contentious. AMD had succeeded in producing the first and second generation x86 microprocessors (8086 and 80286), but by 1987, AMD initiated arbitration concerning Intel's refusal to provide information sufficient for it to produce

the 386 microprocessor. By 1991, AMD successfully overcame this lack of information and designed and manufactured a third generation x86 microprocessor competitive with Intel's 80386.[6] In 1992, the arbitrator ruled in AMD's favor concerning its relationship with Intel, and the arbitrator awarded AMD a royalty-free license to the x86 instruction set.[7]

11. Beginning in 1996, AMD introduced a series of its own (i.e., non-clone) competitive x86 microprocessors, the K5 - K7 chips.[8] The K7, introduced in June 1999, was branded the "Athlon."[9] Subsequent versions included AMD innovations such as multicore microprocessor, 64-bit extensions to the x86 instruction set, on-chip memory control, and HyperTransport.[10] AMD's Opteron server microprocessor and the Athlon 64 included these advances. In April 2005, AMD released the first dual core x86 microprocessor.

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[6] AMD also designed a fourth generation x86 architecture to rival Intel's 80486DX microprocessor.

[7] The arbitrator's decision was upheld on appeal to the Supreme Court of California. Intel also sued AMD in 1990 alleging copyright infringement. A jury found for AMD.

[8] AMD settled on-going litigation with Intel in 1995. Intel agreed that AMD had a right to the x86 instruction set, while AMD agreed that it would develop its own chip architecture to implement the instructions.

[9] [redacted]

[10] Multicore microprocessor package two or more CPUs in a single chip. Multicore CPUs increase system performance providing more computing power in a smaller space. Multicore designs also allow for lower heat dissipation and power consumption. Intel followed AMD's innovation with its own multicore CPUs. AMDs second innovation extended the x86 architecture to 64 bits in its Athlon product line. The existing Intel x86 microprocessors were limited to a 32 bit address space. Intel was developing its Itanium microprocessor (IA64) for the 64 bit address space. The Itanium microprocessor would not maintain x86 compatibility. After the AMD x86 64 bit innovation, Intel adopted the AMD approach of 64 bit extensions to the x86 CPUs. A third AMD innovation was AMD's on-chip memory controller. Making the memory controller a part of the CPU improved memory utilization and enabled multicore system designs to scale in performance. AMD has also led a consortium of companies in the development of an interconnection technology called "HyperTransport" which allows for dramatically improved throughput from peripherals including disk drives and networking connections especially in multicore systems while reducing power consumption.

12. The operating system and applications are developed to be used with a specific hardware platform. Windows is the x86 based operating system that dominates the PC industry. Linux is an alternative operating system available for x86 computing systems.[11] Software applications that are written for Windows or x86 Linux will run only on x86 microprocessor. Because of users' investments in knowledge and software specific to x86 operating systems, it is very costly for computer suppliers, hardware and software developers, and consumers to switch from x86 based computers to an alternative.[12]

13. The microprocessor is one of the most expensive components of most personal computers. [redacted][13] For the particular personal computers referenced in these documents, this is a greater percentage than for any other component.

14. Intel dominates the market for the sale of x86 microprocessors. [redacted][14]

[11] The Mac OS X operating system has recently become available for x86 microprocessors.
[12] In addition, network effects (the value of using an operating system and applications used by most of the rest of the market) and greater software availability motivate new users to prefer x86 based personal computers.
[13] [redacted]
[14] [redacted]

[redacted][15] Because Intel generally sells its microprocessors for more than the competition, its market shares in revenues are considerably higher. [redacted]

15. OEMs buy Intel x86 microprocessors directly from Intel and also from distributors.[17] [redacted][18] Intel is particularly dominant in the OEM direct channel, [redacted][19]

16. Intel is also the primary manufacturer of the "glue" chips that are used to connect x86 microprocessors to the memory and peripherals in personal computers. These glue chips, including the "northbridge" and the

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[15] [redacted]

[16] [redacted]

[17] OEMs that deal directly with Intel also can and do make some purchases from distributors. [redacted]

[18] [redacted] A few microprocessors are sold by distributors to retailers for resale to end-user consumers, either for upgrades or to build a personal computer. I understand these microprocessors are not in the proposed class.

[19] [redacted]

"southbridge," are often referred to as a chipset.[20,21] Intel also manufactures motherboards that are sold to OEMs, VARs and distributors.[22] In some cases, Intel manufactures entire computer systems ("white box" systems) that are re-branded and sold through distributors.

17. Intel sold x86 microprocessors for use in various devices besides PCs. The wide availability of x86 development tools and x86-compatible hardware, and a very large pool of skilled and knowledgeable x86 software developers makes the x86 platform a logical choice for use in non-PC applications such as ATMs, airline check-in kiosks, and industrial automation control equipment. I will refer to these as "embedded applications." Intel also provides its x86 CPUs in a "SOC" or "System On a Chip" package where the CPU and necessary glue logic and some peripherals are manufactured together in a single package. These SOC chips are used in various embedded applications. Intel also made the Microsoft x-Box which included an Intel x86 microprocessor. I understand that Plaintiffs do not assert any claims regarding microprocessors not used in PCs.

[20] The northbridge is known in Intel systems as the memory controller hub. The northbridge handles the communication between the CPU and the RAM. It is the northbridge that AMD has incorporated in the CPU in the 64 bit microprocessor. The southbridge is also known as the I/O controller hub. This chip ties into the northbridge and handles input/output functions such as the disk drive, the BIOS nonvolatile memory, and USB, Ethernet and FireWIre ports.

[21] [redacted]

[22] The motherboard is the primary circuit board providing the electrical connections for the various components of the computer system.

18. Intel manufactures a range of other semiconductor devices and microprocessors including networking chips, communications chips and specialized CPUs such as those used in personal digital assistants and peripheral controllers.

19. Intel sells x86 microprocessors to OEMs, value added resellers (VARs) and distributors. [redacted]

[redacted][23]

20. x86 personal computers are made by a number of OEMs. [redacted]

[redacted][24] [redacted]

[redacted]

21. End users purchasing x86 personal computers include small and large

[23] [redacted]

[24] [redacted]

[25] [redacted]

[26] [redacted]

businesses, public institutions (government and education), and individuals ("households"). [redacted][27] Intel and OEMs target different microprocessors for different end-user markets, linking particular x86 microprocessors to particular personal computers according to the computers' retail price segments point.[28]

22. End users purchase x86 personal computers from OEMs directly, from retailers, and from VARs.[29] Value added resellers assist buyers by assessing their computing needs and recommending and providing appropriate hardware, software, and training. [redacted][30]

[27] [redacted]

[28] [redacted]

[29] The deposition testimony of the named plaintiffs indicates that these plaintiffs are individuals and small to medium businesses. The purchases were made from various sources including directly from OEMs (Dell, Apple, Gateway, IBM), retail stores including CompUSA, Best Buy, Circuit City, Staples, Sam's Club, Costco and J&R Computer World, online retailers such as Alienware.com, CDW.com, Newegg.com, and outpost.com, custom computer builders, and VARs (Nationwide Papers, Creo America's Inc, Professional Business Systems, Bevcomm, Saba Computer Consulting, and Network Solutions).

[30] [redacted]

23. Preliminary analysis of the Intel data shows that Intel's sales of microprocessors used in desktop and mobile personal computers [redacted][31]

24. Microprocessor production is characterized by very significant and important economies of scale. Economies of scale simply mean that as a producer gets bigger its per-unit costs get lower. This occurs in microprocessor production both because of standard technological economies from using larger scale production facilities, and more importantly because of substantial economies from "learning-by-doing." Learning-by-doing means that the cost of production falls as total cumulative output increases. Economics literature has verified the importance of economies of scale and learning- by-doing in the microprocessor industry.[32] For example, Irwin and Klenow find that semiconductor costs fall by 20 percent with each doubling of output.[33]

V. Plaintiffs' Allegations of Intel Anticompetitive Conduct

25. Plaintiffs allege that Intel maintained its x86 microprocessor monopoly

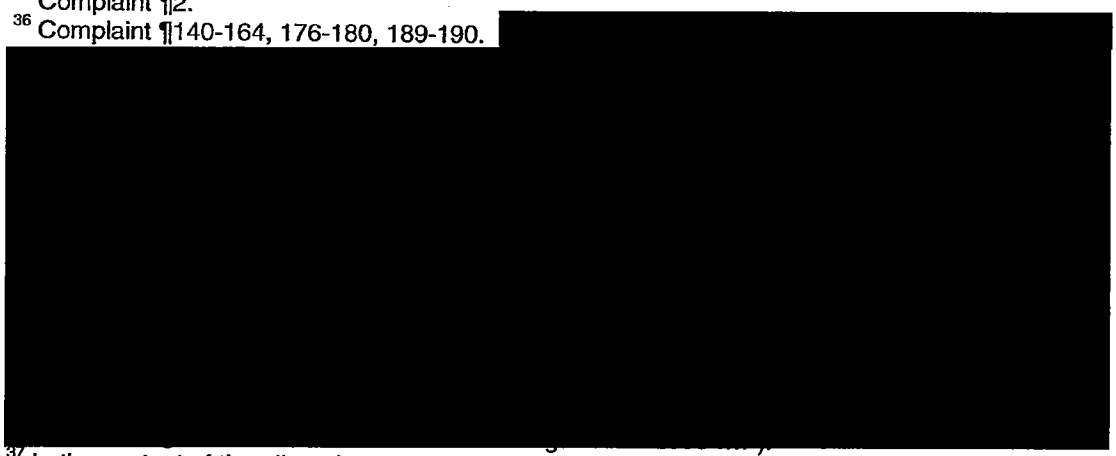
[31] [redacted]

[32] See, e.g., H. Gruber, "The Learning Curve in the Production of Semi-conductor Memory Chips," *Applied Economics,* 1992; Irwin and Klenow, "Learning by Doing in the Semiconductor Industry," *Journal of Political Economy,* 1994; Hatch, Nile and Reichelstein, "Learning effects in semiconductor fabrication," Competitive Semiconductor Manufacturing Program Report CSM-33, University of California at Berkeley, 1994; V Maly, "Cost of Silicon Viewed from VLSI Design Perspective, 31st ACM/IEEE Design Automation Conference Proceeding, 1994; Hatch and Mowery, "Process Innovation and Learning by Doing in Semiconductor Manufacturing," *Management Science,* 1998; E. Meieran, "21st Century Semiconductor Manufacturing Capabilities," *Intel Technology Journal,* 1998; Benavides, Duley, and O'Halloran, "Optimizing Fab Design and Deployment," *Semiconductor International,* 2000; P. Segerstrom, "Intel Economics," Stockholm School of Economics Working Paper 2005; Aizcorbe, Oliner, and Sichel, "Shifting Trends in Semiconductor Prices and the Pace of Technological Progress," Finance and Economics Discussion Series, Divisions of Research & Statistics and Monetary Affairs FRB DC, 2006.

[33] Op. cit. p. 1224.

power through illegal means. Initially, in the mid-1980s to mid-1990s, Intel hampered competition with AMD by failing to adhere to its agreement with IBM that required Intel to license its x86 technology to AMD.[34] Plaintiffs also allege that after AMD had successfully innovated to produce its own x86 compatible microprocessors, Intel acted to limit AMD's access to important customers.[35] According to Plaintiffs, Intel accomplished this through the use of "payments" to selected customers where the payments were explicitly or understood to be dependent on the customers limiting their microprocessor purchases from AMD (or other Intel competitors).[36] According to Plaintiffs, Intel also accomplished this by predatory pricing (i.e., net prices that were below costs)[37] in certain transactions in certain segments of the x86 microprocessor market.[38]

[34] Complaint ¶¶118-120.
[35] Complaint ¶2.
[36] Complaint ¶140-164, 176-180, 189-190.



[37] In the context of the allegations in this case, the proper concept of cost for assessing predation must include the expected R&D and fab plant costs. This is because Plaintiffs' allegations relate to Intel's actions to impede AMD's and other actual or potential competitors' ability to attain efficient size and scale. Thus, the allegations relate to the "long run" decision period in which R&D and plant costs are marginal and variable. Therefore, the correct costs must include these marginal and variable costs.
[38] Complaint ¶172. In addition, Plaintiffs also allege that Intel has attempted to influence industry standards to disadvantage its microprocessor competitors (Complaint ¶¶220-225), that Intel has designed complementary products to disfavor competitors' microprocessors (Complaint ¶¶226-

26. According to Plaintiffs, "Intel's conduct has unfairly and artificially capped AMD's and others' market shares, and it has constrained AMD and others from expanding output to reach the minimum efficient levels of scale necessary to compete with Intel as a predominant supplier to major customers."[39] Plaintiffs also allege that Intel's practices have blocked AMD from competitive access to those "bell-weather" OEMs necessary for success with major commercial buyers.[40] Plaintiffs allege that as a result of AMD's and others' inability to achieve efficient scale and thereby compete fairly with Intel, "Intel's exclusionary and restrictive practices described herein have suppressed competition in the x86 Microprocessor Market, resulting in higher prices for Intel x86 purchases ...."[41]

27. Plaintiffs allege that Intel has engaged in anticompetitive acts to retard actual or potential competitors' sales. For the purposes of this Declaration, I assume Plaintiffs will introduce evidence establishing these allegations. Given the importance of economies of scale and learning-by-doing, this will result in competitors having or expecting higher costs as a consequence of Intel's practices. [redacted]

230), and that Intel has raised the costs of entry to competitors by bundling its x86 microprocessors with motherboards and chipsets. (Complaint ¶189).

[39] Complaint ¶5.

[40] Complaint ¶233.

[41] Complaint ¶234. [redacted]

[42] [redacted]

[redacted][43] Higher costs impacted AMD's and other competitors' and potential competitors' ability to compete with respect to x86 microprocessors. Limiting competitors' available market also impeded their ability and incentive to engage in efficient research and development and thereby adversely impacting innovation in the marketplace. Thus, Plaintiffs' allegations imply that Intel operates under an umbrella of the high cost of its major competitor AMD and/or other actual or potential competitors, which will allow it to set higher microprocessor prices.

28. Absent Intel's alleged anticompetitive conduct, AMD and/or other competitors would have achieved greater scale, lower costs, faster innovation, and lower prices. Intel would have been "forced" by stronger competition to offer buyers better microprocessors, and the microprocessors it actually sold would have been sold at lower prices. Anticompetitive impact from Intel's alleged conduct would extend beyond prices. Competition is a stimulus to innovation,[44] and the consumer

[43] [redacted]

[44] See, e.g., Mansfield et al., *Research and Innovation in the Modern Corporation,* 1971; Mansfield, *Industrial Research and Technological Innovation: An Econometric Analysis,* 1968; Jewkes, Sawers and Stillerman, *The Sources of Innovation,* 1968; Kamien and Schwartz, "Market Structure and Innovation: A Survey," *Journal of Economic Literature,* 1975; Tirole, *The Theory of Industrial Organization,* Ch. 10, 1988; Richard J. Gilbert, "Competition and Innovation" *Journal of Industrial Organization Education,* 2006; Aghion, et al., "Competition and Innovation: An Inverted U Relationship," *The Quarterly Journal of Economics,* 2005; *Federal Trade*

welfare loss from retarding innovation can quickly out-weigh any price impact.[45] [redacted][46] By limiting AMD's and other competitors' or potential competitors' ability to compete, both Intel's and other competitors' innovation incentives are expected to be adversely impacted. With less innovation in microprocessors, Plaintiffs would have faced reduced choices and paid more for lower quality goods compared to the but-for world.

29. Plaintiffs' allegations concern Intel's efforts to restrict AMD's and other competitors' market presence in order to deprive them of scale efficiencies and R&D opportunities.[47] Preliminary examination of discovery materials shows that Intel had various programs under which it made potentially anticompetitive payments to its direct purchasers. These programs were generally and collectively called "Meeting Competition Programs" (MCP). These programs included ECAP (Exception-based Customer Authorized Pricing) payments that sometimes took the form of lower prices for x86 microprocessors.[48] MCP payments also included a category labeled Bid Bucket funds. These funds were typically used to lower the cost to OEMs

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Commission, To Promote Innovation: The Proper Balance of Competition and Patent Law and Policy, 2003.

[45] See, e.g., Solow, "Technical Change and the Aggregate Production Function," *Review of Economics and Statistics*, 1957.

[46] [redacted]

[47] [redacted]

[48] [redacted]

of Intel microprocessors to allow the OEMs to bid aggressively to sell Intel-powered computers to large, usually server customers. Finally, the MCP payments included MDF (Market Development Funds) lump sum payments. These payments would not affect the OEMs' costs of goods sold.[49] [redacted][51]

The Economics of Plaintiffs' Allegations.

30. The evidence I have reviewed indicates that Intel made payments to OEMs that were not competitive "price reductions" but rather "bribes" to buy an OEM's or retailer's loyalty[52] – bribes apparently targeted at market segments,[53] OEMs,[54] VARS, distributors[55] and retailers[56] that were key

[redacted]

portals of expansion for AMD or entry for others. Industry observers have noted the significance of keeping AMD out of important OEMs.[57] Such payments can allow Intel to keep its microprocessor prices high to OEMs, preventing wide spread price erosion of PC prices, and resulting pressure on Intel's market wide microprocessor pricing.[58]

[redacted]

54 [redacted]

55 [redacted]

56 [redacted]

57 [redacted]

58 [redacted]

31. Basic economic principles demonstrate that lower prices from Intel will increase the demand of computers with Intel x86 microprocessors and thereby increase Intel's sales and profits. The economic issue thus arises - why would Intel offer payments to OEMs that were designed to avoid lower PC prices? Preliminary analysis based on the evidence I have examined to date implies that Intel payments to OEMs, distributors and retailers which would limit AMD's and other competitors' market size and also limit OEM and retailer price competition could have been an economically rational and plausible strategy.[59] By offering non-price related payments to strategic OEMs, Intel may minimize the costs of controlling the x86 market.[60]

32. Given Intel's cost advantage from its extensive economies of scale, Intel

[redacted]

[59] By economically rational and plausible, I mean that Intel would expect to increase its profits from engaging in such alleged conduct.

[60] [redacted]

could conceivably have succeeded in dominating the x86 microprocessor market by replacing "bribes" with low prices that undercut competitors' higher costs. However, such a price competition strategy likely would have been quite costly to Intel as it likely would have resulted in lower microprocessor prices market-wide. [redacted][61] Limiting AMD's and other competitors' market shares by paying strategic OEMs and retailers to favor Intel, while maintaining above-competitive prices of x86 microprocessors, can be more profitable than a price competition approach. [redacted][62] At this stage of the case, the important point is that analysis and evidence confirming (or contradicting) such a hypothesis is class-wide in scope.

VI. Economic Evidence Relevant to Showing Impact of Intel's Practices on Intel Personal Computer Microprocessor Prices

33. In this section, I address the economic analysis that can be conducted to show whether Intel's alleged practices would have raised prices paid by all

[61] [redacted]

[62] [redacted] OEMs receiving lump sum payments from Intel were not injured by those payments; however, they nonetheless were overcharged (assuming the truth of Plaintiffs' allegations) because the prices they paid for Intel microprocessors were higher than they would have been in the but-for world. To the extent that the OEMs passed on to their customers Intel's inflated prices but not (as Intel apparently intended) Intel's payments, the OEM's customers would be injured by Intel's alleged anticompetitive conduct.

OEMs (whether buying directly from Intel or through a distributor) for Intel x86 microprocessors used in mobile and desktop computers sold in the United States during the class damages period. I have concluded that such economic analysis is both feasible and common to all class members.

Intel's Market Power

34. The direct purchasers of the relevant Intel microprocessors include both OEMs and distributors. The class-wide threshold issue as to whether these direct purchasers were impacted by Intel's alleged anticompetitive conduct is whether Intel has substantial market power. Only if Intel has substantial market power in a relevant economic market would Intel have been capable of overcharging for x86 microprocessors, or harming its customers through non-monetary anticompetitive effects such as delayed or reduced innovation.

35. Market power refers to the ability of a seller to profitably charge prices above costs, including a reasonable profit.[63] Economists take two approaches to determining whether a seller has market power – a direct

[63] See, for example, Carleton and Perloff, *Modern Industrial Organization,* at page 92. See also, Landes and Posner, *Market Power in Antitrust Cases,* 94 Harvard Law Review (1981) ("A simple economic meaning of the term 'market power' is the ability to set price above marginal cost." at 937). The Courts have accepted this economic definition of market power. See, e.g., NCAA v. Board of Regents of the University of Oklahoma 468 US 85 ("As an economic matter, market power exists whenever prices can be raised above the levels that would be charged in a competitive market." 108, at n. 38) The courts have also defined market power as the ability "to control price or exclude competition." US v. du Pont 351 US 377 at 391 (1956). Conceptually, this definition is the same as the ability to profitably charge above competitive prices. The phrase "monopoly power" is also used to mean market power. In economics, "(t)he terms monopoly power and market power typically are used interchangeably to mean the ability to profitably set price above competitive levels (marginal cost) ..." Carleton and Perloff, *Modern Industrial Organization,* third edition, page 94.

price-cost approach and an indirect market share approach.[64] Under the direct approach, data on the prices charged and costs incurred by Intel would be collected. Such data are being provided by Intel. [redacted] [65] Because a direct market power analysis is based on Intel's margins on the sales of x86 chips, it is class-wide in nature.

36. Using an indirect approach, Intel had substantial market power if there are not good substitutes for x86 microprocessors, if Intel controls a dominant share of such microprocessor sales, and if there are significant barriers to entry into the relevant x86 microprocessor market. These factors – the availability of substitutes, Intel's market share, and barriers to entry – can be assessed on a class-wide basis. I review below my initial examination of the evidence on these factors.

37. The indirect approach to identifying market power starts with market

[64] Generally the direct approach is preferable. See, e. g, Baker, "Market Definition," *Antitrust Law Journal,* 2007, p. 173 ('market definition may not be required when market power or anticompetitive effect can be demonstrated directly..."); Edlin and Rubinfeld, Exclusion or Efficient Pricing: the 'Big Deal' Bundling of Academic Journals," *Antitrust Law Journal, 2004* as reprinted in *From the Selected Works of Aaron Edlin,* http://works.bepress.com/arron_edlin/37, p. ("Market definition is only a traditional means to the end of determining whether power over prices exists. Power over prices is what matters. As is stated in the Areeda, Elhauge and Hovenkamp treatise (citing pp. 267, 325-28), cases such as Microsoft (citing 253 F. 3d at 51), the Areeda, Kaplow and Edlin casebook (citing ¶ 344), if power can be shown directly, there is no need for market definition ...") Courts have also noted that direct evidence of market power is sufficient. See, e.g., *Todd v. Exxon* 275 F.3d 191, 206 (2d Cir 2001) ("evidence of "an actual adverse effect on competition ... arguably is more direct evidence of market power than calculations of elusive market share figures."); *Toys "R" Us v. FTC* 221 F.2d 928, 937 (1st Cir. 2000)("market power can be proved 'through direct evidence of anticompetitive effects'"); and *U.S. v. Baker Hughes Inc.* 908 F. 2d 981, 992 (D.C. Cir 1990) ("'[m]arket share is just a way of estimating market power, which is the ultimate consideration, ... [w]hen there are better ways to estimate market power, the court should use them.'" (quoting *Ball Mem'l Hospital, Inc. v. Mutual Hospital Ins., Inc.,* 784 F. 2d 1325, 1336 (7th Cir. 1986)).

[65] [redacted]

definition.[66] Market definition requires identification of the closest substitutes for Intel's x86 microprocessors. These are the competing x86 microprocessors supplied by AMD, Via and Transmeta.[67] The next step is to ask if non-x86 microprocessors are also reasonable economic substitutes. This question was thoroughly analyzed by Judge Jackson in the Microsoft case.

38. In the Microsoft case, Judge Jackson found that:

> Since only Intel-compatible[68] PC operating systems will work with Intel-compatible PCs, a consumer cannot opt for a non-Intel-compatible PC operating system without obtaining a non-Intel-compatible PC. Thus, for consumers who already own an Intel-compatible PC system, the cost of switching to a non-Intel compatible PC operating system includes the price of not only a new operating system, but also a new PC and new peripheral devices. It also includes the effort of learning to use the new system, the cost of acquiring a new set of compatible applications, and the work of replacing files and documents that were associated with the old applications. Very few consumers would incur these costs in response to the trivial increase in the price of an Intel-compatible PC system that would result from even a substantial increase in the price of an Intel-compatible PC operating system. The response to a price increase would be somewhat greater among consumers buying their first PC system, because they would not have already invested time and money in an Intel-compatible PC system and a set of compatible applications. Apple does not license the Mac OS separately from its PC hardware, however, and the package of hardware and software comprising an Apple PC system is priced substantially higher than the average price of an Intel-compatible PC system. Furthermore, consumer demand for Apple PC systems suffers on account of the relative dearth of applications written to run on the Mac OS. It is unlikely, then, that a firm controlling the licensing of all Intel-compatible PC operating systems would lose so many new

[66] The DOJ/FTC Merger Guidelines, Section 1, provide an expanded discussion of the economic issues important in determining the relevant economic market.
[67] These competitors are described in detail in, for example, [redacted] Neither Via or Transmeta has ever been a significant competitor.
[68] Judge Jackson used "Intel-compatible" synonymously with "x86".

> PC users to Apple as the result of a substantial, enduring price increase as to make the action unprofitable.[69]

39. The only significant change in the market place since Judge Jackson's findings relates to Apple's conversion to the Intel x86 microprocessor architecture beginning in late 2005.[70] This change effectively removes the closest substitute for x86 compatible microprocessor – the Motorola microprocessors previously used by Apple – from the market. The same logic and facts leading to Judge Jackson's Finding that there is a relevant economic market for x86 operating systems are equally applicable to the determination that there is a relevant economic market for x86 microprocessors. During the class period, a consumer who owned an x86 PC and was considering purchase of a new computer would incur substantial costs to switch from an x86 compatible system. And like the operating system, a substantial increase in the cost of the microprocessor would lead to a relatively small percentage change in the price of the PC system.[71] Also, as in the Microsoft case, a new user's only reasonable alternative to an x86 based personal computer was, until recently, an Apple computer. However, as noted by Judge Jackson, Apple computers are more expensive than PCs and they "suffer on account of the relative dearth of applications ..."[72] Thus, it seems clear that a relevant economic

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[69] US v. Microsoft Corporation, Findings of Fact ("Findings"), ¶¶20, 21. These particular findings were accepted by the Appellate Court.

[70] [redacted]

[71] Consider a case in which the microprocessor represented 20% of the costs of manufacturing a personal computer. In that case, a 15% overcharge on the microprocessor would result in only a 3% increase in the cost of making the computer.

[72] Those buyers that found an Apple computer using Motorola microprocessors to be a reasonable alternative to the PC, given competitive pricing of the Intel x86 chips, would be

market for assessing Intel's market power is the worldwide market for x86 microprocessors for desktop and mobile personal computers.[73] Regardless, at this stage of the case, the important point is that the proof for determining the relevant economic market is class-wide in nature.

40. Once the relevant economic market has been defined, the next step in the indirect approach to market power evaluation is to determine whether the alleged monopolist has a dominant share in that market. The relevant evidence in this step is class-wide, and that evidence shows that Intel has maintained a dominant market share of x86 microprocessor sales [redacted] during the period 1997 through 2005.[74]

41. The final step in the indirect examination of market power concerns barriers to entry. The most relevant evidence in this regard concern the significance of intellectual property rights and the very high costs of building an efficient microprocessor fabrication plant.[75] What is also

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expected to have purchased an Apple computer. Such purchasers are therefore not in the proposed class.

[73] The worldwide nature of the geographical market seems clear. Microprocessors are made in fabrication plants throughout the world. The cost of shipping microprocessors is trivial compared to the value. [redacted]

[74] [redacted] Market participants' perceptions of the market are also of relevance in assessing the presence of market power. In this case, OEMs recognized Intel's market power. [redacted]

[75] [redacted] In the Federal Trade Commission's 1998 complaint against Intel, they noted a cost of about $1.6 billion to develop and build an efficient fabrication plant. For a potential competitor with an existing fabrication plant, the cost of the plant is not a barrier to entry. However, the

clearly true is that Intel has maintained very high shares for decades while achieving very substantial profits.[76] During those decades, there has not been any significant entry, which suggests substantial barriers to entry. This evidence concerning barriers to entry is class-wide in scope.

Intel's Microprocessor Pricing

42. Plaintiffs have received two databases from Intel concerning its pricing of microprocessors, [redacted][77] In addition, I and my staff continue to discuss with Intel the meaning and understanding of certain details of the data. Hence, at this time, I can only undertake general and preliminary examination of Intel's pricing.

43. Table 1 summarizes the dollar sales, unit sales and average revenue per unit in six month intervals from the time of introduction of the top 25 selling Intel x86 desktop microprocessors during the 2000-2006 period.[78] The table also includes every 25th microprocessor beyond the 25th (i.e., the 50th, 75th, etc.). During the 2000-2006 period, a total of [redacted] microprocessors were available, and the total U.S. sales were $[redacted]. Table 1 indicates that the top 10 microprocessors accounted for

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limited available market size because of Intel's alleged anticompetitive conduct implies a cost disadvantage that is itself a barrier to entry.

[76] According to IC Insights "Breaking Intel's grip on the PC microprocessor business is a formidable task that few have tried and nearly all have failed or met with limited success." See "Microprocessors 2004." P. 11-6. IC Insights lists AMD, Transmeta, VIA, IDT, National, and Rise as attempted entrants. The later three exited the market. Transmeta and VIA remain as minor competitors in specialty segments of the market.

[77] [redacted]

[78] See Charts and Tables attached to this Declaration as Exhibit D.

[redacted]% of total Intel revenue from the relevant microprocessor sales. Table 1 and Chart 1 also indicate the typical life cycle pricing of desktop microprocessors.[79] The state-of-the-art microprocessor typically sold for about $[redacted] in its first six months after introduction.[80] This price declined on average by about [redacted]% in the second six months after introduction, and another [redacted]% over the next six months.[81] About [redacted]% of desktop microprocessor sales were, on average, made in the first year of the microprocessor' life on the market.[82]

44. Table 2 summarizes the same information as in Table 1 for mobile microprocessors. [redacted] mobile microprocessors were available during the period 2000-2006, and total U.S. sales were $[redacted]. Table 2 indicates that the top 10 microprocessors accounted for [redacted]% of total Intel revenue from the relevant microprocessor sales. Table 2 and Chart 2 also indicate the typical life cycle pricing of mobile microprocessors. [redacted]

[79] Chart 1 (2) shows the average prices for six month intervals for the top twenty five microprocessors for Table 1 (2). Such life cycle pricing is well documented in the economics literature. See, e.g., Aizcorbe, "Why Did Semiconductor Price Indexes Fall So Fast in the 1990s? A Decomposition," *Economic Inquiry*, 2006; Aizcorbe, "Moore's Law, Competition, and Intel's Productivity in the Mid-1990s," *American Economic Review*, 2005; Flamm, "Moore's Law and the Economics of Semiconductor Price Trends," mimeo, University of Texas, 2003; Aizcorbe and Kortum, "Moore's Law and the Semiconductor Industry: A Vintage Model," *Scandinvian Journal of Economics*, 2005; Aizcorbe, "Product Introductions and Price Measures for Microprocessor Chips in the 1990s," mimeo, Department of Commerce, Bureau of Economic Analysis, 2005.

[80] [redacted]

[81] This is for the top twenty five selling desktop microprocessors. Citigroup/Smith Barney describes Intel's pricing as "Intel hardly 'cuts' prices at all but in effect keeps its microprocessor price points static and just scoots its microprocessor further down the pricing stack."

[82] These statistics are for the top twenty five selling desktop microprocessors. Over 97% of the total sales of these microprocessors were made in the microprocessor first 18 months on the market.

[redacted][83] The average prices of the mobile microprocessors fell by [redacted]% in the second six months after introduction, and another [redacted]% over the next six months.[84] On average, about [redacted]% of mobile microprocessor sales were on average made in the first year on the microprocessor' life on the market.[85]

45. Chart 3 shows the specific net transactions net prices Intel charged for the [redacted][86]

[redacted]

46. [redacted]

[83] [redacted]

[84] These statistics are for the top twenty five selling mobile microprocessors.

[85] Over [redacted]% of the total sales of these microprocessors were made in the microprocessors' first 24 months on the market.

[86] [redacted]

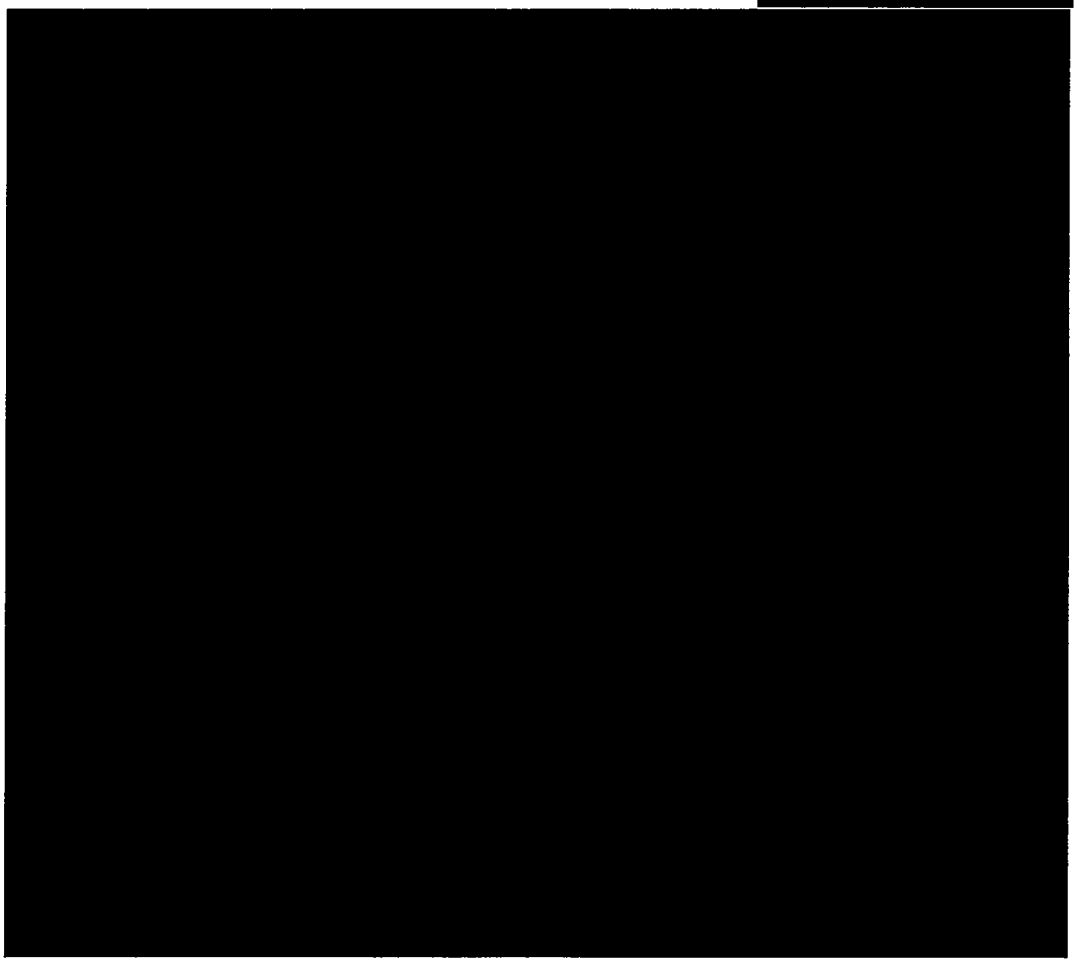
during the first six months on the market, over [redacted]% of these microprocessors were sold at a net price of $[redacted]. In the last five months of the first year of introduction, over [redacted]% of the [redacted] microprocessors sold at a net price of $[redacted]

47. Chart 4A documents the pricing of [redacted]

48. [redacted]

87 [redacted]

49. Chart 5A illustrates the prices that Intel charged for the



[88] A price-month pair means a unique combination of a month and year and a price.

Chart 5B shows the prices at which significant amounts of sales were made. [redacted]

50. Chart 6 details the pricing for [redacted]

51. Chart 7 focuses on the [redacted]

89 [redacted]

[redacted]

52. Finally, Chart 8A illustrates the prices that Intel charged for [redacted]

[redacted]

90 [redacted]

[redacted]

53. Some dispersion in the prices of a particular product is typical in nearly all markets. Some buyers may pay lower prices because they purchase in larger volumes than others, allowing manufacturers' to save costs by better production and shipping planning, and guaranteed recovery of overhead. Some buyers may receive lower prices because they perform certain services for manufacturers. For example, an OEM may receive lower prices because it assists a manufacturer in designing a product for particular uses. Finally, some buyers may receive lower prices because of their unique negotiating or competitive situations.[91]

54. [redacted] I expect the same variations in prices paid by the OEM's for Intel x86 microprocessor prices absent the alleged illegal conduct. Large OEMs would still have been large in the but-for world; and small OEMs would still have been small. OEMs that bought from and

[91] Courts have noted significant price variations for these reasons in other industries involving class certification. See, e.g., *In re Polyester Staple Antitrust Litig.*, MDL Docket No. 3:03CV1516, 2007 U.S. Dist. LEXIS 52525, at *20-*21 (W.D.N.C. July 19, 2007) ("The pricing methods for PSF sales vary from customer-to-customer (and sometimes product-by-product) depending upon a number of factors, including the volume being purchased and the prior dealings/nature of business relationship between the manufacturer and purchaser. . . . Some manufacturers offered rebates. Individual price negotiations were common practice between PSF manufacturers and PSF purchasers, particularly the larger customers."); *In re Mercedes-Benz Antitrust Litig.*, 213 F.R.D. 180, 187 (D.N.J. 2003) ("The purchase prices of some, probably most, cars is negotiated individually between the customer with the dealer. Each customer will vary in her or his ability to get a good price.");
In re Vitamins Antitrust Litig., 209 F.R.D. 251, 267 (D.D.C. 2002) ("Certain defendants argue that plaintiffs cannot prove impact on a class-wide basis due to the significant variance in pricing for each of the different formulations of choline chloride and by each supplier.").

obtained services from distributors would still have done so in the but-for world; and OEMs that got better prices because they were better negotiators would still have been better negotiators in the but-for world.

[redacted] However, with increased competition from AMD in the but-for world, the array or matrix of the typical Intel x86 microprocessor prices would be at a lower level, with the small price differences across OEMs still reflecting legitimate competitive differences.

55. The preliminary examination of the pricing data and the discovery materials indicates that, on occasion, [redacted][92] Thus, it will be necessary to identify and analyze such [redacted]

[92] [redacted]

[redacted][93] In the but-for world, where AMD or other competitors achieve lower costs, the "low" competitive prices would likely be even lower, as would Intel's occasional response. Thus, I expect that the entire matrix of Intel microprocessor prices, [redacted] would be impacted by the alleged illegal behavior; and that all class members would be adversely impacted.[94]

VII. Economic Evidence Relevant to Showing Price Impact of Intel's Anticompetitive Practices on Plaintiffs.

56. I have discussed the class-wide nature of the economic analysis and evidence that could be used to determine whether Intel's alleged anticompetitive conduct impacted Intel's personal computer microprocessor prices. In this section, I address the evidence and analysis relevant to showing whether an inflated price matrix of Intel personal computer microprocessor prices would cause end-users to pay higher prices during the class period for personal computers using Intel x86 microprocessors.

57. The proposed class in this case consists of individuals and entities that purchased personal computers containing Intel x86 microprocessors for their own use. However, Intel does not make computers that are sold

[93] When a fabrication plant is below capacity, the short run marginal costs of supplying additional microprocessors is very low. Therefore, when competitive bidding situations occur, the competitive short run prices can be far below the long run average costs (and long run competitive average price). Thus, in the actual world, the amount by which Intel had to lower its price to compete with AMD in these special situations would have been less than in the but-for world due to the adverse impact on AMD's scale and R&D from Intel's alleged anticompetitive acts.

[94] This expected adverse price impact is separate from the adverse innovation effect discussed above.

directly to consumers.[95] The class members are therefore all indirect purchasers, buying not from Intel but from retailers, OEMs, and value added resellers. As a consequence, as in any indirect purchaser case, the class members' damages depend upon the extent to which any Intel overcharges to OEMs and distributors were passed on to them.

58. This case concerns an alleged overcharge on the major component of personal computers, the microprocessor. The microprocessor is unaltered in the assembly of the personal computer, and its wholesale cost can comprise over 20% of the retail price of the personal computer. In addition, in this case the alleged anticompetitive conduct substantially predated the start of the damage period and any overcharges for the relevant microprocessors would have had sufficient time to become "embedded" in the prices paid for personal computers at each level of distribution by the beginning of the damage period.

59. It is a standard and accepted economic principle that overcharges at one level of the distribution chain are expected to flow through to end-users such that a class of end-users will normally be impacted by an overcharge to the direct purchasers.[96] Harris and Sullivan note that "... passing on of

[95] Intel does make some "white box" systems that are sold through distribution channels.
[96] The economics literature concerning pass-on originated with the analysis of tax incidence (that is, who ultimately pays for a tax.) This literature includes R. Bishop, "The Effects of Specific and Ad Valorem Taxes," *Quarterly Journal of Economics*, 1968; Bulow and Pfleiderer, "A Note on the Effect of Cost Changes on Prices," *Journal of Political Economy*, 1983, Anderson, de Palma and Kreider, "Tax Incidence in Differentiated Product Oligopoly," *Journal of Public Economics*, 2001; Kotlikoff and Summers, "Tax Incidence," ch. 16 in *Handbook of Public Economics*, 2002;; Fullerton & Metcalf, "Tax Incidence," ch. 26 in *Handbook of Public Economics* (Auerbach & Feldstein eds.), 2002; and Barron, Blanchard & Umbeck. "An Economic Analysis of a Change in an Excise Tax," *Journal of Economic Education*, 2004. There is also a significant economic literature demonstrating this principle in the context of overcharge pass-on. See, e.g., Coutroulis

the ... overcharge is not the exception, it is the rule."[97] Hovenkamp writes, "(an) ... overcharge at the top of a distribution chain generally results in higher prices at every level below."[98] Other economists have demonstrated that end-user prices will increase when intermediaries' costs increase under all competitive conditions except when the product at issue has perfect substitutes.[99] For the purposes of my analysis, I am assuming, consistent with the findings in the Microsoft case, that consumers do not have access to close, much less perfect, substitutes for x86 based PCs. Because consumers do not have available close substitutes, the economics literature therefore implies that overcharges by Intel, which dominates the x86 market, will result in all class members paying higher prices for Intel x86 based personal computers regardless of the specific point in the distribution network from which they purchased.

60. In relatively competitive sectors of the economy, the expected pass-on of an overcharge is close to one hundred percent. In the PC marketplace,

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and Allen, "The Pass-on Problem in Indirect Purchaser Class Litigation," *Antitrust Bulletin,* 1999; Cotterill, Egan and Buckhold, "Beyond Illinois Brick: The Law and Economics of Cost Pass-Through in the ADM Price Fixing Case," *Review of Industrial* Organization 2001; Lopatka and Page, "Indirect Purchaser Suits and the Consumer Interest", *Antitrust Bulletin,* 2003; Kosicki and Hill, "Economics of Cost Pass Through and Damages in Indirect Purchaser Cases," *Antitrust Bulletin,* 2006.

[97] Harris and Sullivan, "Passing On the Monopoly Overcharge: A Comprehensive Policy Analysis," *University of Pennsylvania Law Review,* 1979.

[98] Hovenkamp, *Federal Antitrust Policy: The Law of Competition and its Practice,* 1994. Hovenkamp was explicitly considering a monopoly overcharge.

[99] See for example, Bulow and Pfleiderer, op cit., and Kotlikoff and Summers, op cit. Bulow and Pfleiderer analyze the general impact of a cost increase on the product price. They find that "(p)rice will rise by an amount equal to the ratio of the slope of the demand curve to the slope of the marginal revenue curve times the amount of the cost change." P. 183. This implies that the end-user price will increase if a cost increases in all cases where a product does not face extremely close substitutes (implying a horizontal, flat demand curve). Kotlikoff and Summers provide a complex and wide ranging analysis of the incidence of taxes. Nothing in their complex analysis contradicts the finding of Bulow and Pfleiderer that increases in costs generally produce an increase in product prices.

there are substantial numbers of computer distributors, manufacturers and retailers in the distribution chain to class members. [redacted][100] [redacted][101] According to the U.S. Census Bureau, there were as many as 64,000 stores selling personal computers in the United States in 2003.[102] These manufacturer, distribution and retail markets are therefore expected to be highly competitive.[103] According to Business Week - "The pressure to squeeze out every penny of costs yields PCs as commoditized as wheat or cement."[104] Evidence supports the conclusion that the computer markets at issue here are highly competitive.[105] Industry observers and Intel also agree that the OEM and retail markets are highly competitive.[106] [redacted]

[100] [redacted]

[101] [redacted]

[102] http://www.census.gov/econ/census02/data/us/US000_44.HTM#N443. The figure of 64,000 includes 47,000 electronics and appliance retailers (of which over 10,000 are computer and software specialty stores), 3,000 warehouse stores, 8,500 office supply stores, and 5,500 electronic on-line stores. In addition, many general merchandize stores such as Walmart sell personal computers. According to the Boston Consulting Group, by 1998 computers were the largest category of retail goods sold online (*The State of Internet Retailing*, 11/98).

[103] The failure and problems of many major computer retailers such as Future Shop, Computer City, CompUSA, and MicroAge is consistent with a highly competitive retailing market.

[104] *Business Week*, 8/9/06. See also *Business Week*, 9/3/01 ("fierce competition among PC makers ...")

[105] See, e.g., http://www.siliconvalleywatcher.com/mt/arcives /2006/06/the_pcization_o.php, p.3 ("It was easy for anyone to see that that (sic) profit margins for the PC makers were very low."); [redacted]

[106] Dell notes "the Company's practice of rapidly passing component cost declines through to its customers ..." (Dell 10K, 5/1/02, p. 18) HP notes the "net revenues in the PC business were

[redacted][107] Given the competitive nature of the OEM, and computer distributor and retail sectors, there is a strong expectation of a one hundred percent pass-on to proposed class members of any Intel x86 microprocessor overcharges.

61. Industry participants and observers also clearly expect that changes in microprocessor prices are passed-on. [redacted] discuss the close and positive relationship between microprocessor prices and personal computer prices.[108] [redacted][109]

62. While I expect the evidence to show a near one hundred percent pass-on of any overcharge, such that a similar pass-on would apply to the purchases of all class members, for all class members to be impacted there only need be some pass-on of the higher Intel microprocessor prices that would result from Intel's alleged anticompetitive acts. Not only is some pass-on expected, an essentially complete pass-on is implied by basic economic theory.

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impacted by declining average selling prices as a result of decreasing component costs, which are generally passed on to the customer ..." (HP 10K, 10/31/01, p. 24)

[107] [redacted]

[108] [redacted]

[109] See for example [redacted]

63. In some situations, pass-on analysis must consider lags between the changes in prices at one level of the market and changes in prices at the final "retail" level. However, this complication is limited to the short run. To remain viable in competitive marketplaces over the long run, distributors, OEMs and retailers must charge prices based upon how much it costs to run their businesses.[110] In this case, Intel's alleged anticompetitive activities began substantially before the start of the class damage period, such that the impact on the class in this case concerns the long-run. In this case, the OEMs and other sellers of the x86 computers would have had more than sufficient time to take account of the high costs of Intel microprocessors in their pricing of personal computers, meaning that the pass-on issue concerns the "long run" impacts of any Intel overcharge.

64. As conclusively demonstrated in the economics literature, if, in the long run, all OEMs had all faced lower costs of x86 Intel microprocessors in the absence of the Intel overcharges, they would have all charged lower prices for personal computers using these microprocessors.[111] Thus all distributors, VARs and retailers, would face lower OEM personal computer prices, and in the "but-for" world these lower prices would have existed beginning long before the class period. In this situation, regardless of

[110] When competition is less intense, the pass-on of an overcharge can be less than 100 percent. For example, for a monopolist facing an approximately linear demand curve, the pass-on would be 50%of the overcharge. Of course, even with imperfect competition, if there is free entry, as is likely in most sectors of software and computer distribution, exit or entry will drive the pass-on towards one hundred percent. Therefore, in the long run, whether there is perfect or imperfect competition in the distribution or retail markets, a pass-on of about one hundred is expected.

[111] See, for example, Gron and Swenson, "Cost Pass-through in the U.S. Automobile Market," *The Review of Economics and Statistics,* May 2000.

pricing strategies of the distributors, VARs and retailers, the pricing decisions would be based on lower buying costs. Given the competitive nature of the retailing and distribution of personal computers, competition would ensure that all class members would have paid lower prices for personal computers using (lower priced) Intel x86 microprocessors.

65. The economic relationship between x86 microprocessors and personal computers simplifies the analysis of pass-on. Unlike some inputs that may be substantially transformed or altered in production by the purchaser, the microprocessor is essentially unchanged as it passes through distribution.[112] Given this "fixed-proportions" production technology, every dollar reduction in Intel's overcharge causes a dollar cost reduction for every direct purchaser. In addition, unlike some inputs that may constitute a trivial portion of the final goods costs, the microprocessor is one of the significant, if not the most significant, cost of personal computers. Thus, the realities of the personal computer marketplace imply that all class members would have been injured as a result of Intel's alleged overcharges.[113]

66. As indicated in the above discussion, the economic issues related to the

[112] A computer is, in essence, an assembly of parts. To the assembler, a higher cost of one component such as a hard drive is no different than a higher cost of another, such as the microprocessor. In addition, each computer requires a microprocessor. While a lower or higher quality microprocessor may be selected depending on the price, each computer will include at least one microprocessor. The absence of substantial input substitution makes it is far easier to trace through the impact of an input overcharge on final product prices. This issue is discussed in Gron and Swenson, op. cit.

[113] Judge Jackson's finding in the Microsoft case that overcharges on operating systems have "harmed consumers in ways that are immediate and discernible" (Findings ¶409) is relevant. Like the microprocessor, most purchasers of Microsoft's operating system buy the system as part of a computer purchase. If an overcharge of the operating systems harms "consumers in ways that are immediate and discernible," so would an overcharge on the microprocessor.

pass-on of any Intel overcharges in the prices of personal computers are class-wide in nature. As discussed further below, class-wide impact can and will be tested and confirmed through class-wide empirical analysis of the relationship between the cost of Intel x86 microprocessors and the PC prices paid by end-users.

VIII. Estimation of Class-wide Damages

Measuring Intel's Overcharge

67. The first step in measuring the damages, if any, suffered by the class members is to calculate the amount by which Intel overcharged its direct purchasers. This overcharge is the difference between what the direct purchasers actually paid for Intel's x86 microprocessors and the price they would have paid absent (that is, "but-for") Intel's alleged unlawful conduct.

68. Plaintiffs' allegations suggest one possible, conservative and straightforward approach to estimating a lower bound to Intel's overcharges. As discussed above, Plaintiffs allege that Intel paid OEMs and other key customers to favor Intel in order to limit AMD's and other actual or potential competitors' abilities to achieve more efficient scale. The alleged anticompetitive Intel payments included payments in forms allegedly designed to limit price erosion in the overall PC market place. Had Intel instead used legitimate price competition to limit AMD's or other competitors' market share, a minimum estimate of the overcharge would be the amount of those anticompetitive payments as a percentage of those OEMs' Intel PC microprocessor purchases. This "payment amount"

approach is a minimum overcharge estimate because it does not account for the lower Intel prices that would have resulted form enhanced competition absent the alleged anticompetitive conduct.

69. There are other standard and well-accepted methodologies that can estimate the likely but-for level of Intel's pricing absent the anticompetitive impact of the alleged illegal conduct. Data are being obtained that will allow two alternative conceptual approaches to the estimation of overcharges. Both approaches are standard benchmark methodologies comparing the price-cost relationships, that is, margins, earned in more competitive situations that approximate the level of competition in the but-for world, to those earned by Intel in the actual less competitive world subject to the alleged illegal conduct.

70. The first benchmark approach is to compare the relationship of Intel's prices and costs, its margins, for particular Intel products in situations where Intel competed on price, to the margins for the "monopolized" x86 microprocessors. The second approach is to compare the prices and costs achieved by other sellers in more competitive computer chip markets to those earned by Intel on the monopolized x86 microprocessor sales. Both of these are standard benchmark methodologies comparable to those that have been used to estimate overcharges in other antitrust cases and studies.[114]

[114] See, e.g., Blair and Page, "The Role of Economics in Defining Antitrust Injury and Standing," *Managerial and Decision Economics,* 1996; Hoyt, Dahl and Gibson, "Comprehensive Models for Assessing Lost Profits to Antitrust Plaintiffs," *Minnesota Law Review,* v. 60 (1976), pp. 1233-256; Gavil, "Defining Reliable Forensic Economics in the Post-Daubert/Kumho Tire Era: Case Studies

Benchmarks using Intel Data

71. In the but-for world, AMD and Intel likely would have been major competitors in the sale of x86 microprocessors. Via and Transmeta likely would also have been more significant competitors than in the actual world. Other competitors may also have entered the market. Therefore, in the but-for world, there likely would have been significant competition among at least four competitors. Preliminary examination of the benchmarks proposed below indicates that they should proxy the nature and degree of competition that would have existed in the but-for microprocessor market.

72. There are a number of benchmarks that can be developed using Intel's data in order to estimate Intel's but-for x86 prices. These alternative benchmarks include: 1) Intel's pricing in more competitive lines of business outside the x86 market; 2) Intel's pricing of specific microprocessors with more competitive pricing within the x86 market; and, 3) Intel's pricing in periods in which Intel's market power over x86 microprocessors was attenuated.

Intel benchmarks outside the x86 market.

73. Preliminary analysis indicates three possible benchmarks outside the x86 market for which data will be available from Intel. In addition to microprocessors, Intel makes a number of other products. Of these other

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from Antitrust," *Washington and Lee Law Review,* Summer 2000; Hovenkamp, Lemley and Jans, *IP and Antitrust: An Analysis of Antitrust Principles Applied to Intellectual Property Law,* Aspen 2004, §6.3; " Pearlstein, *Antitrust Law Developments,*: 5th ed, 2002, pp. 873-880; Zohn, "How Antitrust Damages Measure Up with Respect to the Daubert Factors," *George Mason Law* Review, v. 13:3, pp. 703-705.

Intel products, network chips, ARM chips, and NOR flash memory appear to be good benchmarks candidates to measure the but-for relationship between prices and costs in the x86 market absent the alleged illegal activity.

74. WiFi and WiMax wireless networking chips made by Intel are used in desktop and mobile computers to link the computers to networks (hereafter called PC networking chips). Preliminary information indicates that the PC networking chip market has features analogous to the but-for microprocessor market. The PC networking chip market is a relatively concentrated industry, with a limited number of major players including Atheros, Broadcom, Intel, and Qualcomm.[115] This is similar to the market structure that likely would have existed in the but-for x86 microprocessor market. Also like the x86 microprocessor market, continued success in the PC networking chip market requires significant research and development expenditures.[116] Technological innovation has enabled wireless transmission speeds to improve from less than 11 megabits per second to over 300 megabits per second, with increased transmission

[115] According to EETimes (http://www.eetimes.com/showArticle.jhtml?articleID=202804472) , Intel had a 26% market share of network microprocessor in 2006.

[116] See http://pcworld.about.com/od/servers/Intel-network-chips-get-up-to.htm, http://english.people.com.cn/200506/19/eng20050619_191050.html, http://www.betanews.com/article/Intel_Builds_New_Laser_Based_Microprocessor/1158594956, and http://www.news.com/Intel-adds-security-to-network-chips/2100-1035_3-962009.html for descriptions of Intel innovations in network chips. See http://www.neoseeker.com/news/4477-first-optical-networking-chip-intel-beaten/ for examples of competitors' innovations.

reliability and greater range as well as reduced power consumption – an important feature for notebook PCs.[117]

75. ARM chips (Advanced RISC Machine) are RISC microprocessors used in embedded designs in consumer electronics applications, automobiles, and other devices. ARM Ltd., a British company, licenses the fundamental ARM architecture (the "design") to a number of other companies including Intel. . These other companies incorporate the design in the products they develop and manufacture, competing by offering chips with more capabilities, using less power and possessing other attributes valued by their customers. Until recently, Intel's family of ARM chips was sold under the XScale brand,[118] and used in a variety of applications including PDAs, smartphones, set-top boxes, and home entertainment centers.[119] In these markets, there are relatively few competitors. In addition, the competitors engage in significant R&D to improve their product designs. Hence, Intel's margins for its XScale ARM chips should provide a reasonable benchmark for the Intel margins in the but-for x86 microprocessor market.

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[117] The Industry standards governing these products have gone from 802.11A and 802.11B to 802.11G and now to 802.11N during this period, allowing for the interoperability of wireless products from a variety of vendors. Moreover, the evolution of these wireless products, including those from Intel, has occurred in tandem with a host of complementary wireless networking products including wireless routers, wireless access points and now wireless media extenders from an even broader array of companies including Netgear, DLink, Linksys (Cisco) and dozens of others.

[118] Intel sold its XScale business to Marvell in 2007, exiting the business.

[119] See, e.g., http://developer.intel.com/design/intelxscale/.

76. Flash memory is non-volatile memory in that it retains information absent electrical power, unlike DRAM or RAM memory, which constantly requires electrical current to maintain its content. Flash memory is used in various electronic devices including PDAs, mobile computers, cameras, and phones. NOR and NAND flash memory refer to types of flash memory with a particular architectures of the transistors.[120] NOR-based flash memory is ideal for the storing of program code that rarely needs to be updated, such as the computer's BIOS.[121] The market for NOR-based flash memory is relatively concentrated, and research and development are important to continuing success.[122] Until earlier this year, Intel manufactured both NOR and NAND flash memory products. Intel's NOR flash memory products competed with those from Hynix, Renasys, Samsung, SanDisk, Spansion, STMicroelectronics and Toshiba. Substantial investment is required in order to compete and to remain competitive in the Flash memory market. Fabrication facilities (i.e., the factory) for manufacturing semiconductor devices such as Flash memory chips can cost upwards of $2.5 billion. During the period from 2000 to

[120] Simplistically, in NOR flash the cells are connected in parallel while in NAND flash the cells are connected in series.

[121] NAND flash memory, a more recent innovation than NOR flash memory, is faster, cheaper and more durable than the NOR version. However, it does not allow byte-level random access. NAND-based flash memory is used for storing relatively larger amounts of data such as are used for USB keys ("Thumb drives").

[122] Intel recently sold its NOR flash memory products to Numonyx. Numonyx lists 12 different forms of NOR flash memory, including products specialized to auto uses, wireless uses, and data storage . Numonyx describes various innovations including "flexible partition read-while-write/erase operation, synchronous burst and asynchronous page mode read operations, 1.8 v operations, enhanced factory programming, wide temperature ranges, pin compatibility, system speed, and reliability. See http://www.numonyx.com/en-US/MemoryProducts/NOR/Pages/NOR.aspx.

2006, competitors have made substantial improvements in the manufacturing technologies as well as in the speed, size, power requirement and capacities of Flash memories.

77. An economically attractive feature of using these benchmarks for the estimation of Intel's possible x86 overcharges is that these markets are subject to similar demand factors that might have short run influences on Intel's x86 prices. In addition, the data should be directly comparable as it would all be Intel data. Data have been requested from Intel on its prices and costs for each of these three product categories over the period 2000-present.[123] The data have been requested in a form that will match up to the data on Intel's x86 prices and costs. In addition, documents have been requested from Intel concerning the market structure and competitive situation in each of these potential benchmark markets.

78. Preliminary review of the discovery materials confirms the general feasibility of this benchmark approach. Intel documents summarizing the margins earned for both x86 microprocessors and for NOR flash memory show that [redacted][124] Preliminary analysis indicates that [redacted]

[123] See Plaintiffs' Second Request for the Production of Documents, May 1, 2008. This Request asks for data to show Intel's costs, manufacturing margins, COGS, overhead, R&D, and gross margins on a quarterly basis for networking chips, ARM chips and NOR flash memory.

[124] [redacted]

79. Implementation of a benchmark approach using price and cost data from outside the microprocessor market would require further investigation of the competitive nature of these benchmark segments compared to that of x86 microprocessor market in the but-for world. However, preliminary research does indicate general similarity of the industry structures to that expected in a competitive microprocessor industry. In addition, economic models and empirical research regarding the impact of market structure on prices could be used if adjustment for this factor is needed.[125] Use of price and cost data from these benchmark markets would also require investigation of plant investment costs, R&D costs, and technological progress in the benchmark segments relative to the x86 microprocessor market. Having three alternative benchmarks with price, cost, and R&D expense data can provide a basis for adjustment if necessary. While these issues can only be fully dealt with after all the data have been produced and further analysis conducted, it is important for class certification purposes that the proposed approach will rely on data that will be available and that the analysis of that data will be class-wide in nature.

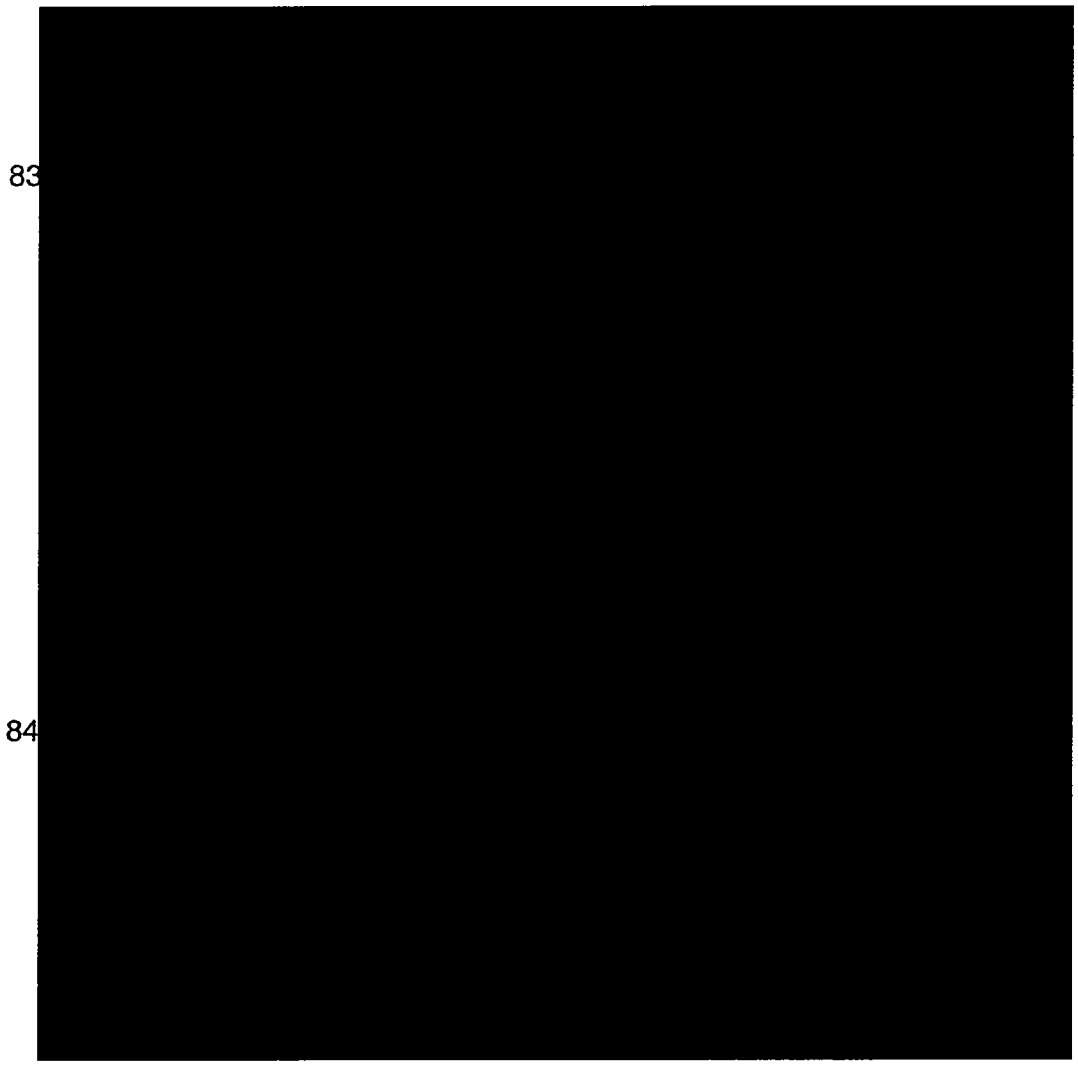
[125] The literature includes Collins and Preston, "Price-costs Margins and Industry Structure," *Review of Economics and Statistics*, 1969; Clarke and Davies, "Market Structure and Price-Cost Margins," *Economica,* 1982; Kwoka and Ravenscraft, "Cooperation vs. Rivalry: Price-Cost Margins by Line of Business,' working paper 127, FTC, 1985; Domowitz, Hubbard, and Petersen, "Business Cycles and the Relationship Between Concentration and Price-Cost Margins," *Rand Journal of Economics*, 1986; Domowitz, Hubbard, Glenn and Petersen, "Oligopoly Supergames: Some Empirical Evidence on Prices and Margins," *Journal of Industrial Economics,* 1987; Hall, "The Relationship between Price and Margin Cost in US Industry," *Journal of Political Economy,* 1988; Schmalensee,"Inter-Industry Studies of Structure and Performance" in Schmalensee and Willig, *The Handbook of Industrial Organization*,1989; Sutton, *Sunk Costs and Market Structure*, MIT Press,1991; Sutton, T*echnology and Market* Structure, MIT Press, 1998; Weiher, Sickles and Perloff,"Market Power in the U.S. Airline Industry," in *Economic Issues in Measuring Market Power: Contributions to Economic Analysis,* 2002. See also Carlton and Perloff, op cit., pp. 269-273.

Benchmarks from the x86 microprocessor market.

80. As discussed, in the but-for world, there would have been at least four competitors, and possibly more. Therefore a conservative benchmark could be developed based on a subset of x86 microprocessor products or time periods in which there was a relatively heightened level of price competition between Intel and another microprocessor producer.

81. [redacted]

82. [redacted]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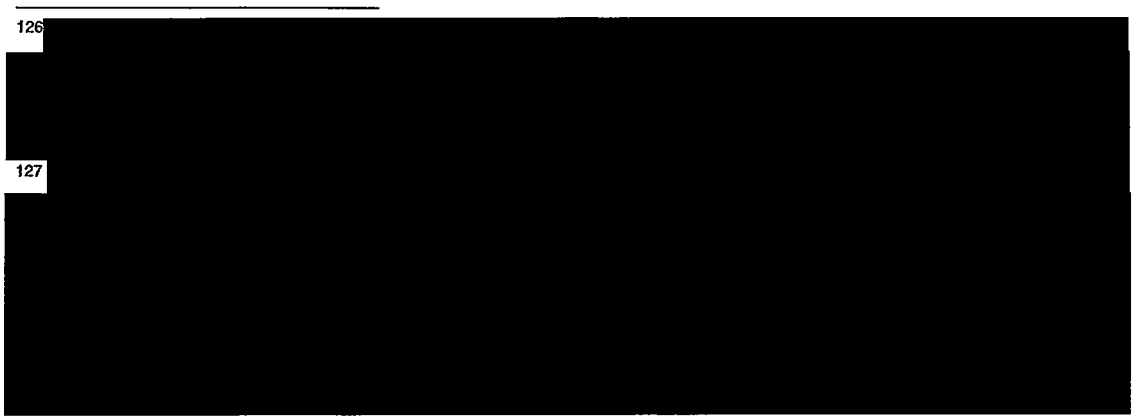
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[redacted]

85. In addition to the possible use of a more competitive microprocessor segment from which to infer a but-for benchmark price-cost relationship, a more competitive time period may also provide a conservative benchmark. Recently, Intel has been subject to increased antitrust scrutiny. The Japanese Fair Trade Commission investigated Intel's relationships with OEMs and ruled in 2005 that Intel had engaged in unfair business practices.[129] In July 2005, the European Commission seized documents from Intel's European offices and in July 2007 filed an antitrust case against Intel alleging anticompetitive practices with respect to OEMs.[130] By 2006, a number of large OEMs including Dell, HP, IBM, Fujitsu and Toshiba began offering significant PC models powered by AMD microprocessors. By the fourth quarter of 2006, AMD achieved a market share of over [redacted]%.[131] Increased price competition apparently began impacting Intel margins. As a result of Intel microprocessor price cutting, Mercury Research reported fourth quarter 2006 Intel margins down to

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[128] As mentioned, assuming the evidence shows that AMD's ability to compete was adversely impacted by Intel's anticompetitive acts, then AMD would not offer a true competitive threat to Intel. Therefore, even the margins earned by Intel in market segments where AMD was relatively stronger would not by the true competitive margins, and those customers purchasing computers reflecting these more competitive prices would still be adversely impacted. In this regard, this benchmark is also conservative. Use of such a benchmark would also not estimate overcharges for those class members that purchased the relevant Celeron based PCs. [redacted]

[129] [redacted]

[130] http://www.techworld.com/opsys/news/index.cfm?newsid=11651; http://www.reuters.com/article/businessNews/idUSN2635336720070726.

[131] [redacted]

50% from 61% a year earlier.[132] This evidence suggests the possible use of Intel's price-cost relationships in mid- to-late-2006 as a benchmark for the more competitive pricing that would occur in the but-for world.

A Benchmark using non-Intel Data.

86. Another reasonable benchmark would be based on margins earned in other markets that shared attributes with the but-for market for x86 microprocessors. One reasonable approach is to select a sample of companies making computer chips that faced competition similar to that expected in the but-for world. This approach is based on the hypothesis that but-for the alleged illegal actions, by 2001 Intel would have earned margins comparable to other semiconductor companies facing unfettered competition.[133,134]

87. An illustration of the general feasibility of this approach begins by identifying other semiconductor companies and then comparing Intel's margins earned over the period 2001 through 2006 to the margins earned during the same time period by competitive semiconductor companies. Table 3 lists nine publicly traded companies involved in the semiconductor business.[135] Five of the nine companies have substantial semiconductor business but they also have other significant non-semiconductor

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[132] Reported in *Business Week*, 10/17/2006. The *New York Times* reported that "AMD and Intel have been locked in a fierce price war for the last year." 3/6/07.

[133] The overcharge percentage would be given by (1-(1-MonopMargin)/(1-BenchMargin)), where MonopMargin is the relevant "monopoly" margin, and BenchMargin is the relevant benchmark margin.

[134] *Business Week* recently noted that "disk drives may be the ultimate tech commodity. ... But because there are so many competitors, drive margins hover near 6% ... Meanwhile, Intel Corp. ... enjoys 50% margins." 1/15/07.

[135] The analysis is limited to publicly traded companies due to data availability.

revenues. Four of the nine companies are primarily in the semiconductor businesses and, thus, likely provide the most appropriate benchmark.

88. Table 3 shows the gross margins (revenue less cost of goods sold) and net margins (gross margin less selling expenses) of these nine companies and for Intel as reported on their 10K SEC filings for each year 2001-2006. The competitive benchmark margin could then be estimated from averages of these companies' margins, or a subset of their margins. Proper application of this approach would require investigation of the competitive conditions, and the capital and R&D investments requirements for the markets in which the benchmark companies operated as compared to the x86 "but-for" microprocessor marketplace.[136]

89. These margin comparison benchmark approaches could also be disaggregated to the specific microprocessor levels (e.g., Pentium 4, Pentium M, Pentium III ...) and/or to sub-periods within the damage period. For example, the margins earned by Intel on particular microprocessors at different times of the product lifecycle could be determined as could the competitive yardstick margins at the same times.[137] While this approach may imply different overcharges at different times and for different microprocessors, any such variation would not

[136] For example, the average of the nine companies' margins is highly influenced by the very low margins of Micron Technology (yet Micron was alleged to be involved in a DRAM price fixing conspiracy which may have inflated its margins. See http://www.internetnews.com/bus-news/article.php/3318861.) Taking an average of a number of companies and a number of years will help to "correct" for unusual situations.

[137] See Charts 1 and 2 above. There has been substantial research and published literature on the life cycle pricing of semi-conductors. This literature could be used to estimate the competitive life cycle pricing derived from a competitive life cycle margin. From comparison of the competitive life cycle margins to those actually earned by Intel, the life cycle overcharges could be estimated.

preclude connecting a particular overcharge with a particular computer purchase. Data on the average time from microprocessor purchase to retail computer sale could be used to link the end-user computer purchase to the overcharge on the microprocessor in the computer.

90. It is important to emphasize that each of these possible benchmark methodologies for estimating the direct purchaser overcharge is based on data that either are or will be available and each methodology is class-wide in nature.

Measuring the Pass-on of Intel's Overcharge to Class Members

91. Once Intel's alleged overcharges to direct purchasers have been estimated, calculation of any damages to the class members requires an additional step. In acquiring personal computers using the relevant Intel x86 microprocessors, members of the class did not deal with Intel, but rather with OEMs, retailers, or VARs. Therefore, it is necessary to determine how Intel's overcharge to its customers impacted the PC prices that the OEMs, retailers or VARS charged the end-users.

92. Economic theory discussed above suggests that a near one hundred percent pass-on in the competitive OEM, distribution and VAR sectors is expected. [redacted][138] This implies that OEMs and retailers pass-on Intel's prices. Industry experts

[138] [redacted]

acknowledge that OEM component cost changes will be passed-on to end users.[139] The Vice Chairman of Dell Computer, Kevin Rollins, noted that Dell "takes a price reduction and pass[es] it on immediately."[140] Economic literature on the effect of taxes on prices also supports the expectation that there will be a near full pass on of a cost change as a consequence of the elimination of an Intel overcharge.[141]

93. The relevant factual circumstances in this case facilitate the measurement of pass-on. Here it is not necessary to undertake the difficult task done in most tax incidence analyses where small changes in tax rates are related to near contemporaneous prices. Rather, the relevant question concerns how a presumably substantial, longstanding embedded overcharge affects end user prices. It is also not necessary to trace the overcharge through each link in the distribution chain, rather, what matters are only the overcharges paid by the end-users.[142] Nor is it necessary to consider the factors that determine any lag between direct

[139] See, e.g., "Microprocessor discounts invariably lead to lower prices for PCs ..." (CNET News.com 8/23/99); "Those purchasing systems can expect these (microprocessor) price reductions to translate into PC price reductions in as little as two weeks or as much as two months ..." (CNET News.com 1/30/97)

[140] As quoted in Elaine Chen, "Low Prices Will Shape the Year," Electronic News, January 5, 1998. [redacted]

[141] See, e.g., Fullerton and Metcalf, "Tax Incidence," *Handbook of Public* Economics, Chapter 26, 2002; Don Fullerton and Gilbert E. Metcalf, *The Distribution of Tax Burdens*, International Library of Critical Writing in Economics, No. 155 (Northampton, Mass.: Edward Elgar Publishing, Inc., March 1, 2003); Poterba, *National Tax Journal,* June 1996; Besley and Rosen, "Sales Taxes and Prices: An Empirical Analysis," NBER Working Paper, July 1998. These papers successfully undertake a far more complex pass-on analysis than is required to estimate the damages in this case since they consider a host of different products being sold in a host of different markets.

[142] I do not expect the distribution path that a PC takes to the end-user to be an important factor in the amount of the pass-on. End users care about the price they will pay and choose to deal with the seller offering the best deal given the desired service level. Regardless of how a product reaches the final purchasers, successful sellers must compete with the price of other comparable sellers and with other sellers using different distribution methods.

purchaser overcharges and end user price increases because, whatever those factors, the lag is certainly expected to be shorter than the period when the Intel overcharge was in place prior to the beginning of the damage period. In addition, during the class period, Intel's price changes frequently were announced in advance giving OEMs knowledge of the forthcoming price changes and allowing the resale price to include Intel's price changes.[143]

94. The objective of the pass-on analysis in this overcharge context is not to identify all the economic factors that may lead to particular retailers or OEMs charging higher or lower prices than others.[144] That is, there are numerous reasons particular OEMs, VARS or retailers charge different prices from each other or different prices over time for the same goods. These reasons include, among other things, differences or changes in business strategy, competitive conditions, inventory levels, and service. However, whatever the factors are that cause some sellers to charge high prices and others low prices, those same factors would have existed in the but-for world such that the same distribution of prices, but-for the Intel

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[143] [redacted] http://www.businessweek.com/ technology/content/jun2007/ tc20070612_414317.htm ("Intel (INTC), said to be cutting prices as much as 50% for its premier Core 2 Duo line for high-end computers and servers, no doubt expects to find a newly reinvigorated rival nipping at its heels, if not outrunning it, as early as next month. But cutting prices is a move chipmakers make on a regular basis, and one that analysts say Intel's customers have known about for months.")

[144] Even if some sellers of PCs sell below cost, a pass on of an overcharge is still expected. Below cost loss-leader prices occur because a seller may anticipate receiving profits from sales of other goods if a below cost priced PC attracts buyers to a store. Nonetheless, the degree to which a seller will price below cost is based on the cost. If the costs of loss-leader PCs had been lower in the but-for world without the alleged Intel overcharge, a rational seller would decrease the price of the loss leader.

overcharge, would have prevailed.[145]

95. In the but-for world, Intel would have charged lower microprocessor prices to its customers. From the perspective of these direct purchasers, a lower Intel x86 microprocessor price is simply a lower cost of an input that is not changed or altered in supplying the final product to the end-users. Therefore, the reasonable economic expectation is that a change in Intel's price to its customers, if the overcharge were eliminated, would have the same impact on end-user prices as a comparable change in other costs faced by the OEMs, distributors, VARs and retailers.

96. In addition, there is no reason that an OEM would treat differently a cost change resulting from an Intel price reduction from a cost change resulting from, for example, using a more or less expensive Intel microprocessor model, a more or less expensive hard drive, inclusion of additional software or reduction in pre-installed software, or other changes to the personal computer implying higher or lower costs. Thus, by statistically identifying how personal computer prices to end-users were impacted by differences in the manufacturers' costs regardless of the source of that cost difference, a reasonable and reliable inference as to how prices to end-users were impacted by Intel's overcharges can be established.[146]

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[145] Certainly the price of a particular computer is expected to vary substantially within a region during some period of time. This fact simply is not relevant to the issue of pass-on of an industry wide overcharge. With or without the overcharge, a variation in prices is expected. Indeed, the overcharge does not impact the factors that lead to and explain the variations in prices. All such factors that I am aware of are independent of whether there is or is not an overcharge included in the prices of Intel x86 microprocessors.

[146] The statistical analysis need not be specific to microprocessors. The question of interest is how retailers and OEMs react to cost changes, from whatever source, that approximate the size of an Intel microprocessor overcharge.

This simplifies the estimation of the expected overcharge pass-on.

97. Multiple regression analysis can be used to calculate the expected pass-on rate using data on how the prices of personal computers to end-users changed when more or less expensive microprocessors were used, and when other more or less expensive components such as video cards, hard drives, speakers, or software were included with the personal computers.

98. Regression analysis is a widely accepted statistical tool frequently used by economists in both research and litigation related studies. "Multiple regression analysis is a statistical tool for understanding the relationship between two or more variables."[147] I have used regression analysis many times in my academic research. I have also performed regression analysis in estimating damages and pass-on in other antitrust cases.

99. [redacted]

[147] Daniel Rubinfeld, "Reference Guide to Multiple Regression," in *Reference Manual on Scientific Evidence,* Federal Judicial Center, 1994, page 419. Multiple regression simply refers to multiple variables being used to explain another variable. For example, a multiple regression analysis could be conducted to "explain" people's weight in which multiple "explanatory" variables might include height, waist size, and wrist size.

[148] [redacted]

100. In addition to the data obtained from Intel, various additional data relevant to pass-on have been or are being obtained from a number of alternative sources. Exhibit C attached to this declaration summarizes the data currently obtained, and data that are being obtained. I have sampled from the data currently available to illustrate the type of empirical work that can be conducted to determine pass-on.

101. Preliminary empirical analysis has been conducted on the data obtained from [redacted][149] These data allow analysis of the relationship between the prices paid by class members to [redacted] for personal computers and the costs incurred by [redacted] in assembling and selling the computers. Using these sample data, regression analysis has been conducted to demonstrate the feasibility of quantifying [redacted] pass-on of cost changes in its prices to its customer. As an example of the type of class-wide analysis that can be conducted to determine the pass-on, a preliminary fixed-effects regression model of the following form was estimated:

$$P_{i,t} = c + b_1 * C_{i,t} + b_{2j} * D_j + b_{3t} * D_t + e_{i,j,t}$$

where:

i represents each computer model sold by [redacted] for which data were made available;
j represents a unique configuration of components other than the microprocessor
t represents the date of the transaction;
$P_{i,t}$ is the retail price of computer system *i* at time *t*;
$C_{i,t}$ is the cost to [redacted] of the Intel microprocessor in computer system *i* in month *t*;
D_j is a series of 0, 1 dummy variables with a value of 1 for each unique configuration of components other than the microprocessor;

[149] [redacted]

D_t is a series of 0,1 dummy variables with a value of 1 for each date t;
and, $e_{i,t}$ is an error term.

The coefficient b1 in the regression equation identifies the dollar increase in the sales price of a computer corresponding to a $1 change in the cost of the microprocessor, holding all other components and their corresponding costs constant. Table 4A summarizes the results of the regression estimation. As shown, the results are highly statistically significant with a cost coefficient of [redacted].[150] This implies that a $1 increase in costs translates into a $[redacted] increase in the retail sales price of a [redacted] computer.[151]

102. Data on costs and prices have also been received or will be received from other OEMs including [redacted] The data include the direct costs of the computer to the OEM, the configuration of the computer,[152] and the price at which the computer was sold. For OEM direct sales, these data will allow estimation of the relationship between the cost differences for these OEMs' computers and differences in their sales prices as in the exemplar [redacted] analysis above.

[150] Data, computer programs and regression results for all the preliminary analysis are contained in separate electronic files.
[151] The pass-on at issue concerns the impact of an industry wide price decrease because of the elimination of the Intel overcharge. [redacted]
[152] [redacted]

For sales that occur through VARs or retailers, the data in conjunction with data on prices paid by class members, as described below, will allow quantification of the impact of OEMs' cost changes on class members' prices.

103. Data have been obtained or will be obtained from retailers of personal computers including [redacted] These data include information on what the retailers paid for personal computers and what they sold those computers for.[153]

104. Preliminary analysis of the [redacted] data has been conducted to illustrate the class-wide approach for estimation of the pass-on of Intel's overcharges for purchases from retailers. The preliminary regression examines the relationship between the costs of personal computers to [redacted] and its retail sales prices. The exemplar regression specification for this analysis is:

$$P_{i,t} = c + b1*Costs_{i,t} + b2*Season_i + b3*Year_i + b4*OEM_i + e_{i,t}$$

where,

i represents each computer sold;
$P_{i,t}$ is the retail price of the personal computer *i* in year *t*;
$Costs_{i,t}$ is the cost of the personal computer *i* in year *t*;
$Season_i$ is a series of 0/1 variables for the season in which the computer *i* is sold (back to school and Christmas);
$Year_i$ is a series of 0/1 variables for the year of the sale;
OEMi is a series of 0/1 variables for the OEM that manufactured the computer *i*; and
$e_{i,t}$ is an error term.

153 [redacted]

The results are summarized in Table 4B. Again the results are highly statistically significant and find more than a [redacted] pass-on, a $1 increase in the cost of a computer purchased by [redacted] is found to result in an increase in the retail price of that computer of $[redacted]

105. Similar regression analysis was also performed on data received from [redacted] The regression specification employed for this retailer is analogous to the one described for [redacted]. The results of this preliminary regression analyses is summarized in Table 5. For [redacted] the results imply slightly more than a [redacted]% pass-on - a $1 change in the cost of the personal computer leads to a $[redacted] change in the retail price of the computer. The results are highly statistically significant.

106. Given the presence and significance of national chain PC retailers and location-independent internet PC sales, I do not expect the pass-on rate to vary according to the state in which sales are made. However, the sales data available from the retailers are specific to the location of the store. From the data currently processed, Table 6 shows the locations of the sales by state for [redacted] for 2005. The Table also highlights those states for which Plaintiffs have state specific claims. As shown, from this preliminary sampling of data, there are significant sales for the relevant states; therefore, the data will allow examination of the extent to which there is any significant variance in pass-on by state.

107. Plaintiffs have also obtained or expect to obtain data from value added resellers including [redacted]. These data provide

information on the costs of computers to these VARs and the prices at which they sell them. For those datasets already in my possession from [redacted], I have been able to perform similar regression analyses as those done for retailers [redacted].[154] The results are shown in Table 7A and 7B. Again, the data indicates a more than full pass-on of any Intel overcharge. The highly statistically significant regression results imply that a $1 change in cost is expected to lead to a $[redacted] increase in the retail price for [redacted] and a $[redacted] for [redacted]

108. Plaintiffs have also requested and expect to obtain data from four major distributors of personal computers and microprocessors. See Exhibit C. The distributors are [redacted]. These distributors likely supply smaller OEMs and retailers such that these data will allow examination of the pass-on within the distribution chain of increases in both microprocessor prices and computer system prices.

109. Data are also being collected from seven smaller specialty OEMs.[155] The small OEMs were chosen to include both white box manufacturers and specialty system manufacturers. Analysis of these data will be performed to investigate whether the OEMs size or focus impacts the expected pass-on rate.

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[154] In the [redacted] regression, neither the year dummy variables nor the controls for the Christmas and Back-to-School season were significant. I removed them from the regression. I also did not have information on the manufacturer of the computer sold for [redacted] and did not include dummy variables for the manufacturer as I did for the retailers and [redacted]

[155] Document subpoenas were served on the following OEMs – ZT Group, ESys, Premio, ABS Computer, Ateck Computers, Flextronics, and Systemax.

110. Data are also being collected from six small retailers.[156] The retailers include three in California, and two each in Maine and Michigan. As for small OEMs, analysis of these data will be performed to investigate whether retailer size impacts the expected pass-on rate.

111. Under my supervision, my staff has been collecting data on the prices of computers sold on the internet. These data cover 19 time periods between November 2005 and December 2007. The surveys collected the sales prices for personal computers for which the purchaser could choose alternative Intel x86 microprocessors. All other characteristics of the computer were held constant. The data include the dates of sale, the websites, the manufacturers and model names, a description of the microprocessor, and the retail price at which the computers sold. Data from Intel on the cost of the microprocessors were merged with the survey information.[157] After the merging, a total of 156 unique computer models and 477 associated prices were available.[158] Regression analysis was then performed in which the computer price was related to the cost of the Intel microprocessor.[159] The highly statistically significant results of this analysis are summarized in Table 8 and indicate that a $1 increase in the

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[156] Document subpoenas were served on the following small retailers – Central Computer Systems, Santa Clara, CA; ClickAway Computers, Campbell, CA, RV's Computers, Watsonville, CA; The Computer Place, Lewiston, ME; Computer Essentials, Bangor, ME; Ann Arbor Computer Systems - A2 Computer, Ann Arbor, MI; and Southgate Computers, Southgate, MI.

[157] To merge the processor cost information with the retail price data, the analysis was restricted to Intel microprocessors, and the microprocessor were matched based on model, speed, cache, and brand. In the event of multiple matches, I took an average of the costs associated with the matched microprocessor.

[158] The original data included 633 unique computer models and 2870 unique microprocessors choices.

[159] I regressed the retail price of a computer on the cost of the microprocessor using a fixed effects model where the fixed effect is a computer model sold on a specific date.

cost of the microprocessor included in a personal computer resulted in a $[redacted] increase in the selling price of the personal computer.

112. Additional data have been collected that will allow examination of the pass-on rates for smaller retailers and specialty retailers. Under my supervision, price information has been collected on 3940 computers advertised in PC Magazine over the period 2001-2007. This information includes the prices and detailed characteristics of the computers.[160] Data from Intel on the cost of the microprocessors will be merged with the retail price information. Regression analysis relating the retail price differences to the microprocessor cost differences will then provide an alternative method to estimate the proper overcharge pass-on.[161]

113. The empirical approaches and preliminary results discussed here indicate that a standard, reliable and accepted economic methodology can be used to estimate the pass-on of any Intel overcharge. The preliminary results support the predictions of economic theory and the results of prior econometric analysis of pass-on rates in other situations, along with the predictions of industry experts – a reduction in the cost of manufacturing

[160] The information includes the vendor, location, manufacturer, type, model, microprocessor, microprocessor speed, RAM, RAM type, the size, speed and manufacturer of the hard drive, the inclusion, size and type of any monitor, graphics card, CD/DVD, speakers, modem, wireless, battery, software, and other extras. Retailers from ten states (CA, NY, FL, IL, WA, TX, SD, KN, VA, NJ) are included.

[161] I do not have the cost data for the various computer components. I therefore anticipate a hedonic regression approach in which price is the independent variable, and the dependent variables would include the microprocessor cost and a series of 0,1 variables controlling for the other components. The hedonic regression approach that will be applied to this data is a standard empirical approach. See, for example, Berndt, Griliches and Rappaport, "Econometric Estimates of Price Indexes for Personal Computers in the 1990s," *Journal of Econometrics,* 1995; Berndt and Griliches, "Price Indexes for Microcomputers: An Exploratory Study," *NBER Working Paper W3378,* June 2004; Goolsbee, "Competition in the Computer Industry: Online versus Retail," University of Chicago GSB Research, November 2000 (http://faculty.chicagogsb.edu/austan.goolsbee/research/ecompute.pdf);

and selling a personal computer will result in a near equal or more than equal change in the price of the personal computer. In the context of plaintiffs' allegations, this demonstrates that there are feasible class-wide methods to estimate the pass-on to class members of any Intel x86 Intel personal computer microprocessor overcharges.

Damage Formula

114. Having described how the overcharge to direct purchasers can be measured, and how the pass-on of that overcharge in personal computers prices can be determined, the damages to the class members will then be given by

$$D_{MYST} = Purchases_{MYS} * OC_{MY} * Pass\text{-}on\%_{YS},$$

Where: D_{MYST} are the damages from purchase of a personal computer with microprocessor M in year Y from source S,[162]
$Purchases_{MYST}$ are the purchases of a PC with Intel microprocessors M in year Y from source S,
OC_{MY} is the overcharge to direct purchasers for Microprocessor M in year Y, and
$Pass\text{-}on\%_{YS}$ is the estimated pass-on percent for year Y from source S.[163]

Disaggregating the Class-wide Damages.

115. The analysis described above allows estimation of the overcharge to an individual class member specific to, if necessary, the time of purchase, the source of purchase, and the x86 Intel chip family included in the personal computer purchased. However, in order to determine the class-wide

[162] This formulation allows for different overcharges to be estimated depending on the particular microprocessor P, the time of purchase Y, and the source (OEM direct, retailer, VAR) S.
[163] This formulation allows for separate pass-on percents for sub-periods and for purchase source type. To the extent the data confirm a near 100% pass-on, across-the-board, the analysis will be simplified.

damages additional analysis will be necessary. The sales data from Intel provides all sales worldwide. Yet, I understand that the class includes only purchases in the United States, or alternatively in just 26 states. I also understand that for some of the states, because of state law, the class may include only personal computers purchased by households.[164] Thus, in order to determine the appropriate class-wide overcharges, it will be necessary to estimate the sales of Intel x86 based personal computers specific to the United States. In addition, it may be necessary to break down these sales by state. Finally, it may be necessary to break down personal computer purchases by households for one or more states.

116. The first step of this analysis would be to determine the sales of Intel x86 based personal computers in the United States. [redacted] Data as to U.S. sales for [redacted] will also be available. [redacted]

[164] I understand that Rhode Island is one such state.

[165] [redacted]

[166] [redacted]

[167] [redacted]

[168] [redacted]

[169] [redacted]

117. After estimating the number of Intel x86 based personal computers sold in the United States, the next step will be to disaggregate the total U.S. purchases by state. The data obtained in discovery will provide a substantial sample of class member purchases from major OEMs selling directly to end users [redacted]. These data will identify the location of purchasers making the sales, allowing estimation of the distribution of personal computer sales by state. In addition, the U.S. Department of Commerce conducted a survey in 2003 that provides data on the number of households by state with computers in 2003.[170] The sample distribution from the discovery data can be verified by comparing it to the distribution of household computers provided by the U.S. Department of Commerce.

118. I currently have assembled the [redacted] sales by state. These data give the [redacted] sales of Intel x86 based personal computers of over $[redacted]. I have done preliminary analysis of the 2005 [redacted] sales data. Table 9 shows the distribution of these sales by state. Table 9 also shows the distribution of household computers by state from the Department of Commerce survey. As seen in the Table, the two data sources provide very similar estimates. Table 9 highlights the 26 states included in the proposed sub-class. A conservative estimate of the percent of x86 personal computers purchased in these states would be the lower of the [redacted] estimate or the CPS estimate.

[170] Table 1B, Presence of a Computer and the Internet for Households, by State, October 2003. http://www.census.gov/population/www/socdemo/computer/2003.html.

119. Finally, the estimates of computer sales by state described above can be further broken down into the business versus home purchases. The Department of Commerce data mentioned above are specific to households with computers, and it is given by state. [redacted][171] In combination with data from OEM direct sales, these will provide an estimate of total home personal computer purchases by quarter. These data will provide a verification of the estimates of Intel x86 based personal computer household purchases from the Department of Commerce data.

[171] [redacted]

The foregoing is true and accurate to the best of my knowledge and belief.

Keith B. Leffler, Ph.D.

5/15/08
Date

THE EXHIBITS TO THIS DOCUMENT ARE REDACTED IN THEIR ENTIRETY